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3924 MEADE ST.
DENVER, COLORADO

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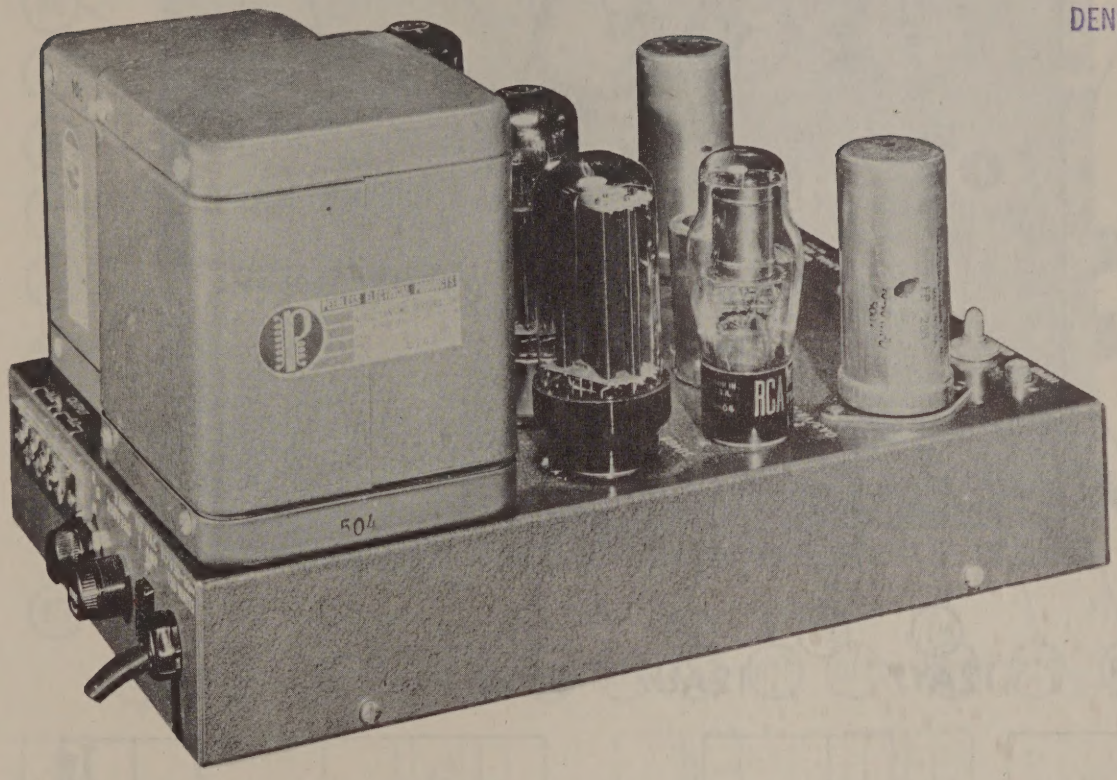
ALTEC-LANSING
MODEL A-340A



ALTEC-LANSING
MODEL A-340A

TRADE NAME	Altec-Lansing Model A-340A
MANUFACTURER	Altec-Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.
TYPE SET	AC Operated 35 Watt Audio Power Amplifier
TUBES (Six)	Types: 12AY7 AF Amp.-Phase Inverter, 12AU7 Driver, (2) 6550 Output, 0A3 Regulator, 5U4G Rectifier
POWER SUPPLY	110-120 Volts AC-50/60 Cycles
RATING	1.52 Amp. @ 117 Volts AC

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

ALTEC-LANSING
Model A-340A

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		Altec Lansing PART No.	STANDARD REPLACEMENT		
V1	AF Amp. - Phase Inv.	12AY7	12AY7	9A	
V2	Driver	12AU7	12AU7	9A	
V3	Audio Output	6550	6550		
V4	Audio Output	6550	6550		
V5	Voltage Regulator	OA3	OA3	4AJ	VR75 Used as alternate.
V6	Rectifier	5U4GB	5U4GB	5T	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	Altec Lansing PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1A	▲40	500		FP288	TM-D40-500	D-275	
B	▲40	500					
C2A	▲40	500		FP288	TM-D40-500	D-275	
B	▲40	500					
C3	50	50		TC39	TD-50-50	FM-0550	
C4	50	3		TC30	TD-50-6	MMT-350	
C5	50	3		TC30	TD-50-6	MMT-350	

FIXED CAPACITORS

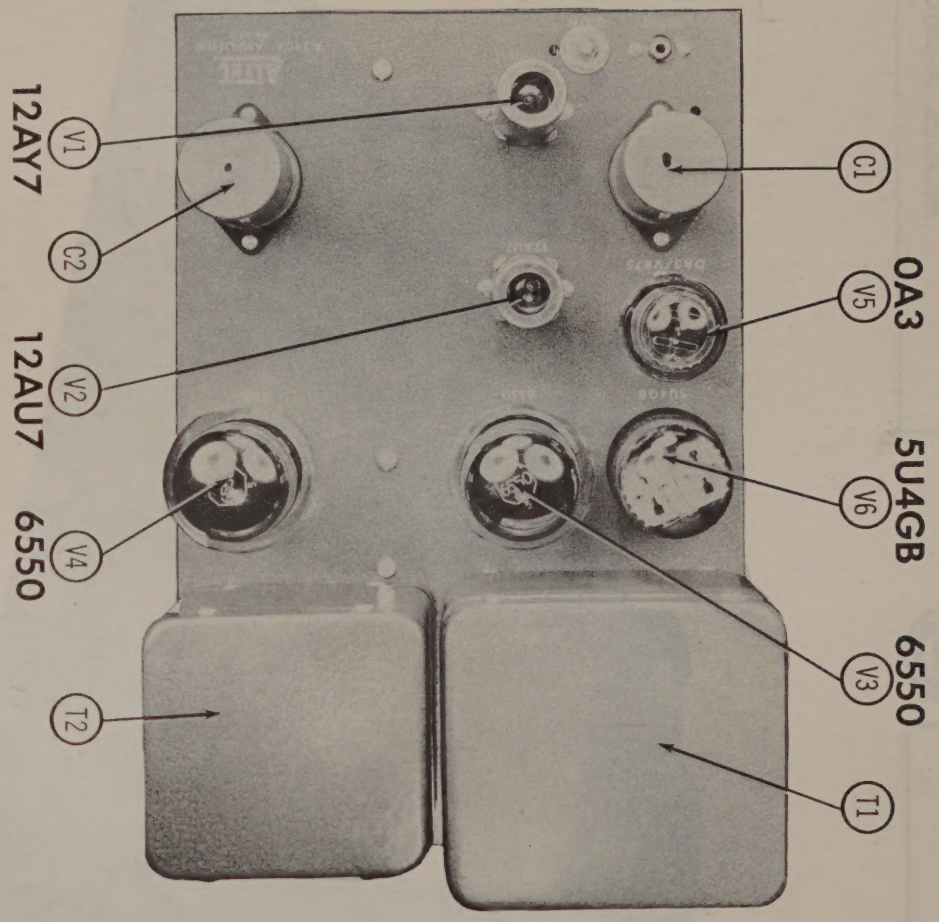
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	Altec Lansing PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	
C6	.25	200				PT4025	
C7	33			D6-330	831-330	ZT-5433	
C8	680			D6-681	811-681		
C9	.5	400				PT405	
C10	.5	400				PT405	
C11	.22	400				PT4022	
C12	.22	400				PT4022	
C13	.22	400				PT4022	
C14	1500				811-152		

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Altec Lansing PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	200KΩ	½		Q13-130	A47-250K-Z	AB-51	U-44	Gain
B	Shaft			SQ	FKS-1/4	AK-1	Not Req.	Attach to R1A.
R2A	1Ω							Damping factor (Wire Wound)
B	1Ω							Attach to R2A (Wire Wound)

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Altec Lansing PART No.	IRC PART No.	
R3	22KΩ	½		BTS-22K	
R4	1000Ω	½		BTS-1000	
R5	47Ω	½		BTS-47	
R6	240KΩ 5%	1		BTA-240K 5%	
R7	6800Ω	½		BTS-6800	
R8	68KΩ	½		BTS-68K	
R9	68KΩ	½		BTS-68K	
R10	47KΩ	1		BTA-47K	
R11	1Meg	½		BTS-1Meg	
R12	1500Ω	½		BTS-1500	
R13	47KΩ	½		BTS-47K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Altec Lansing PART No.	IRC PART No.	
R14	1Meg	½		BTS-1Meg	
R15	47KΩ	½		BTS-47K	
R16	100KΩ	½		BTS-100K	
R17	150Ω	10		1 3/4A-150	
R18	100KΩ	½		BTS-100K	
R19	220Ω	½		BTS-220	
R20	680Ω	½		BTS-680	
R21	.47Ω	1			
R22	100Ω	½		BTS-100	
R23	47KΩ	½		BTS-47K	
R24	10KΩ	2		BTB-10K	
R25	47Ω	1			

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	Altec Lansing PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ 1.52A	780VCT .210ADC	5VAC @ 4A	6.3VCT @ 4A	6142					

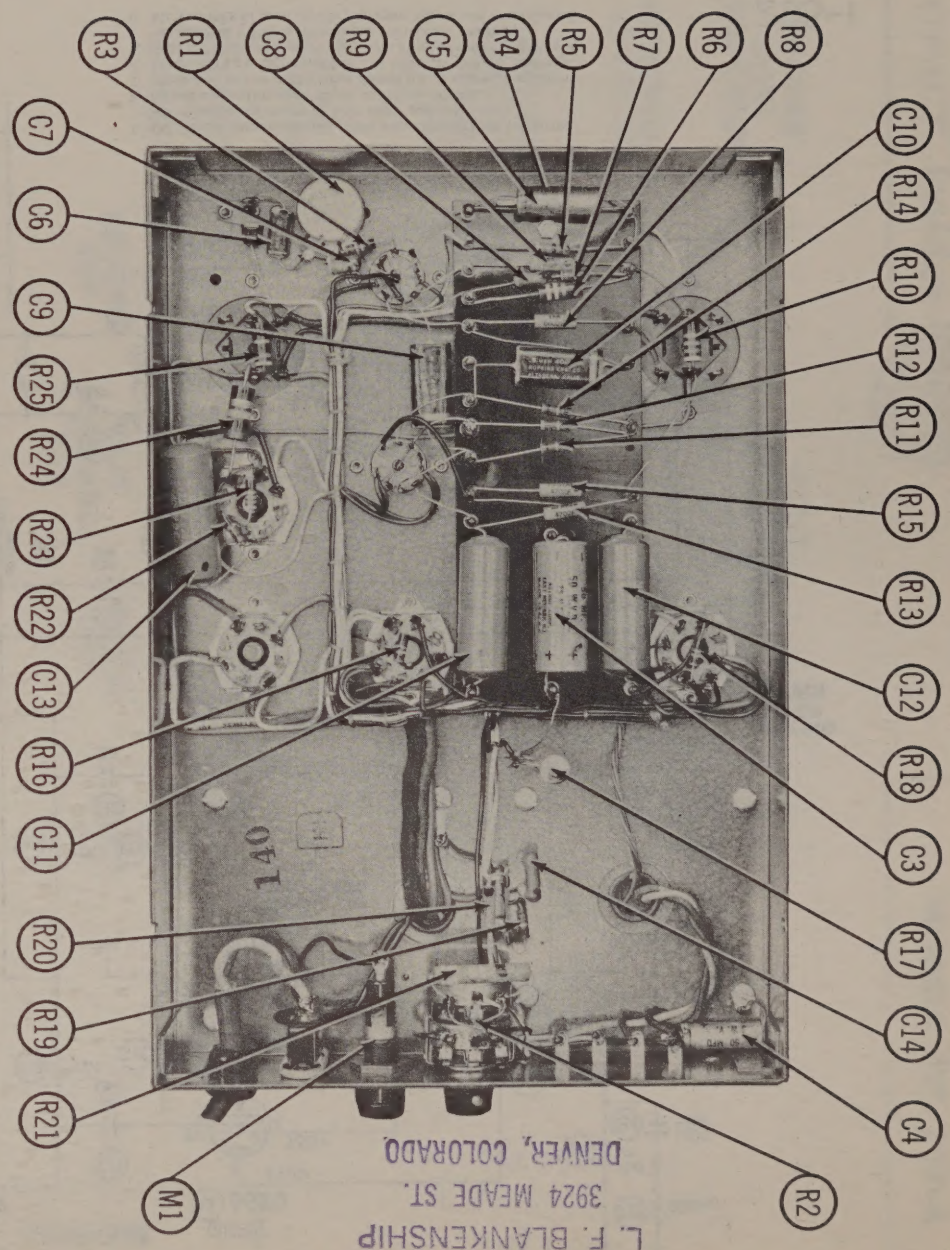
TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	Altec Lansing PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	4.4KΩ	16Ω Tap @ 8Ω	16345		A-3100 ① ②	A-8053 ①			① Drill new mounting holes. ② Tape 4Ω lead.

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Altec Lansing PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	3A 250V			312003 (3AG3A)	342001	AGC3	HKP

CHASSIS—BOTTOM VIEW



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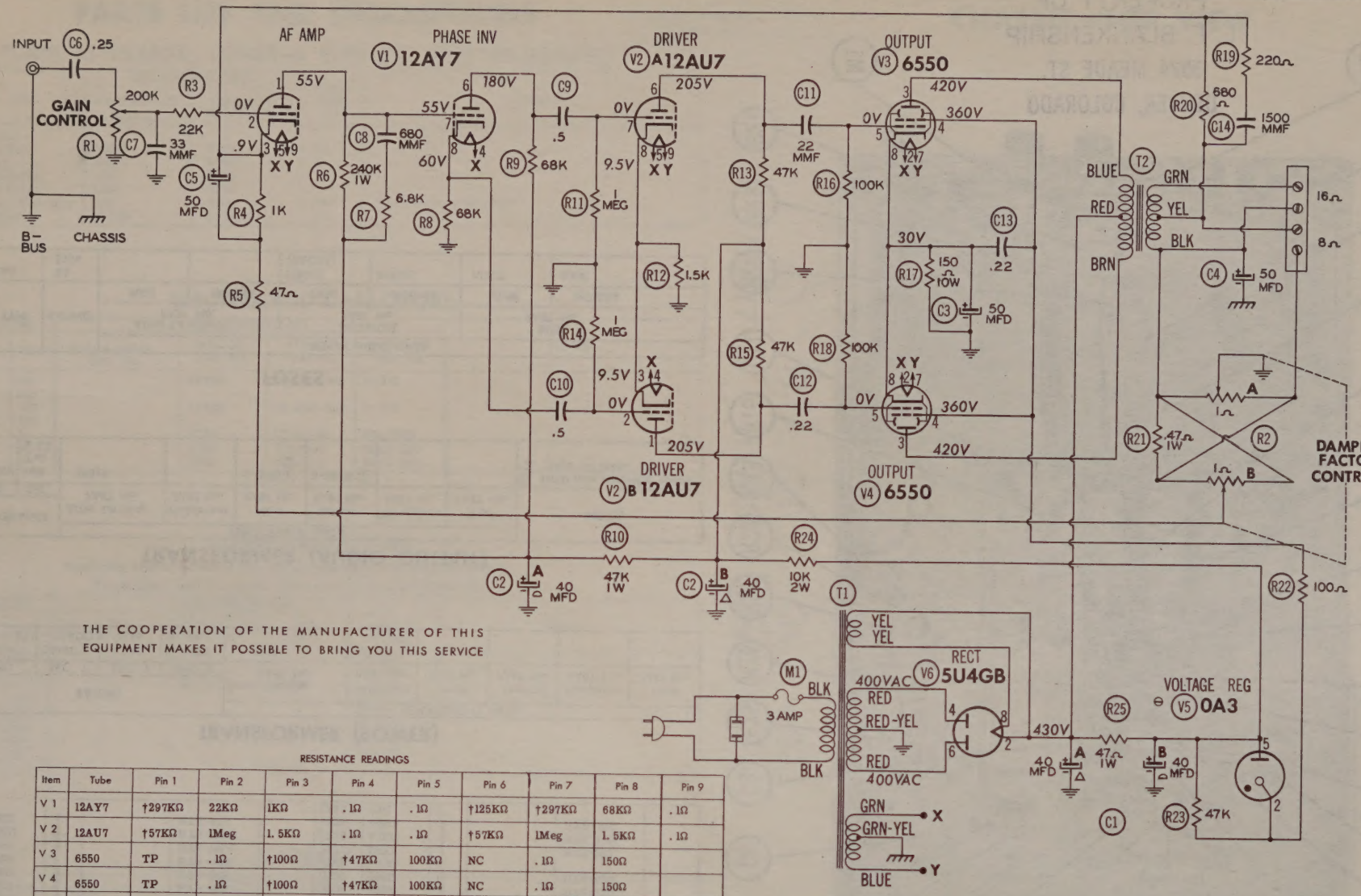
ALTEC-LANSING
Model A-340A

ALTEC-LANSING
Model A-340A



THE COOPERATION OF THE MANUFACTURER OF THIS EQUIPMENT MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AY7	†297KΩ	22KΩ	1KΩ	.1Ω	.1Ω	†125KΩ	†297KΩ	68KΩ	.1Ω
V 2	12AU7	†57KΩ	1Meg	1.5KΩ	.1Ω	.1Ω	†57KΩ	1Meg	1.5KΩ	.1Ω
V 3	6550	TP	.1Ω	†100Ω	†47KΩ	100KΩ	NC	.1Ω	150Ω	
V 4	6550	TP	.1Ω	†100Ω	†47KΩ	100KΩ	NC	.1Ω	150Ω	
V 5	0A3/VR75	TP	†47KΩ	NC	TP	†47Ω	TP	NC	NC	
V 6	5U4GB	NC	1Meg	NC	300Ω	NC	300Ω	NC	1Meg	

†MEASURED FROM PIN 8 OF V6.
TP-TIE POINT.
NC-NO CONNECTION.

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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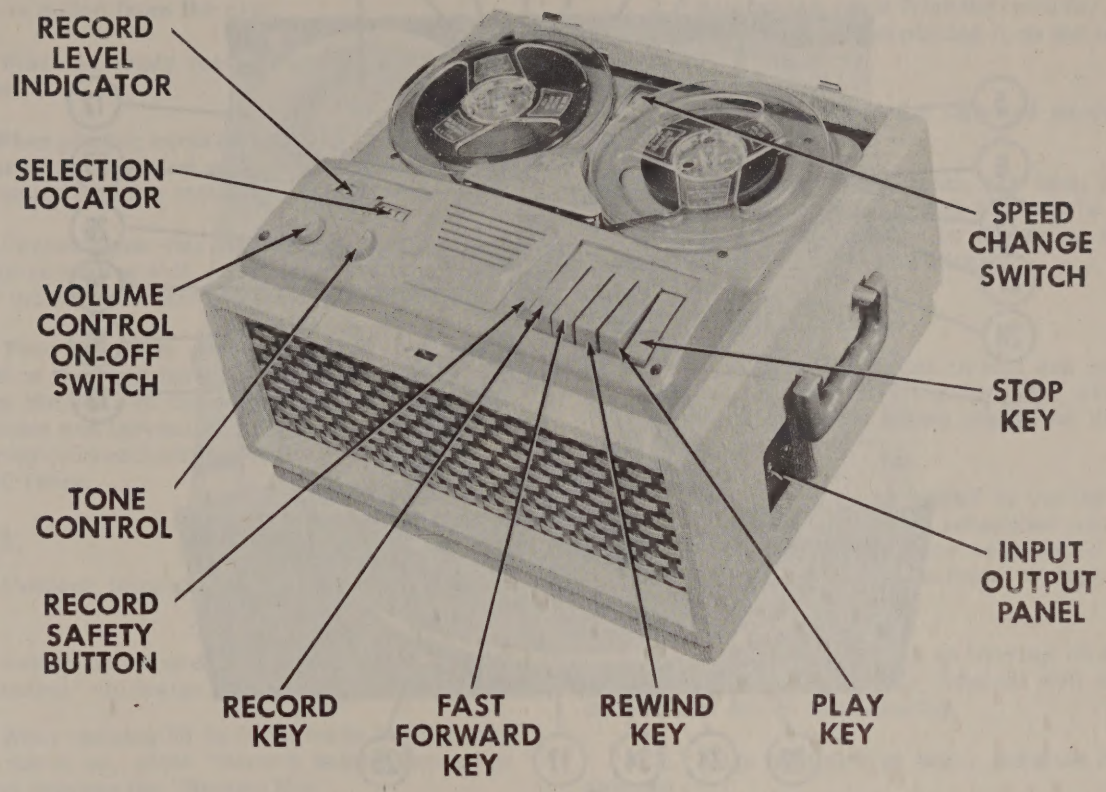

Figure 1

GENERAL INFORMATION

Ampro Models 757 and 757-A Tape Recorders are mechanically and electrically alike. Model 757-A is mounted in an extremely rugged case designed to protect the unit against rough handling encountered in heavy duty operation and Model 757 is housed in a leatherette covered case of suitable construction for home use.

Both models are of the dual track type, permitting two separate tracks of material to be recorded on a reel of tape and played back with no loss of frequency response or quality. Recordings can be made from a radio, television receiver, or phonograph, in addition to those made directly from the microphone. Recordings can be played back through the self-contained speaker or an external speaker may be used through use of the "Ext. Speaker" jack.

Models 757 and 757-A have two tape speeds, 3 3/4 and 7 1/2 inches per second. Changing speeds is accomplished by sliding the "Speed Change Switch" to the desired position, either 3.75 or 7.50.

These recorders are designed to operate on 60 cycle, 105-120 volts, A.C. supply only.

CAUTION: Before connecting recorder to line supply be absolutely certain that it agrees with the above specifications.

Manufactured by:

Ampro Corporation
2835 North Western Avenue
Chicago 18, Illinois

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AMPRO
MODELS 757, 757-A

AMPRO
MODELS 757, 757-A

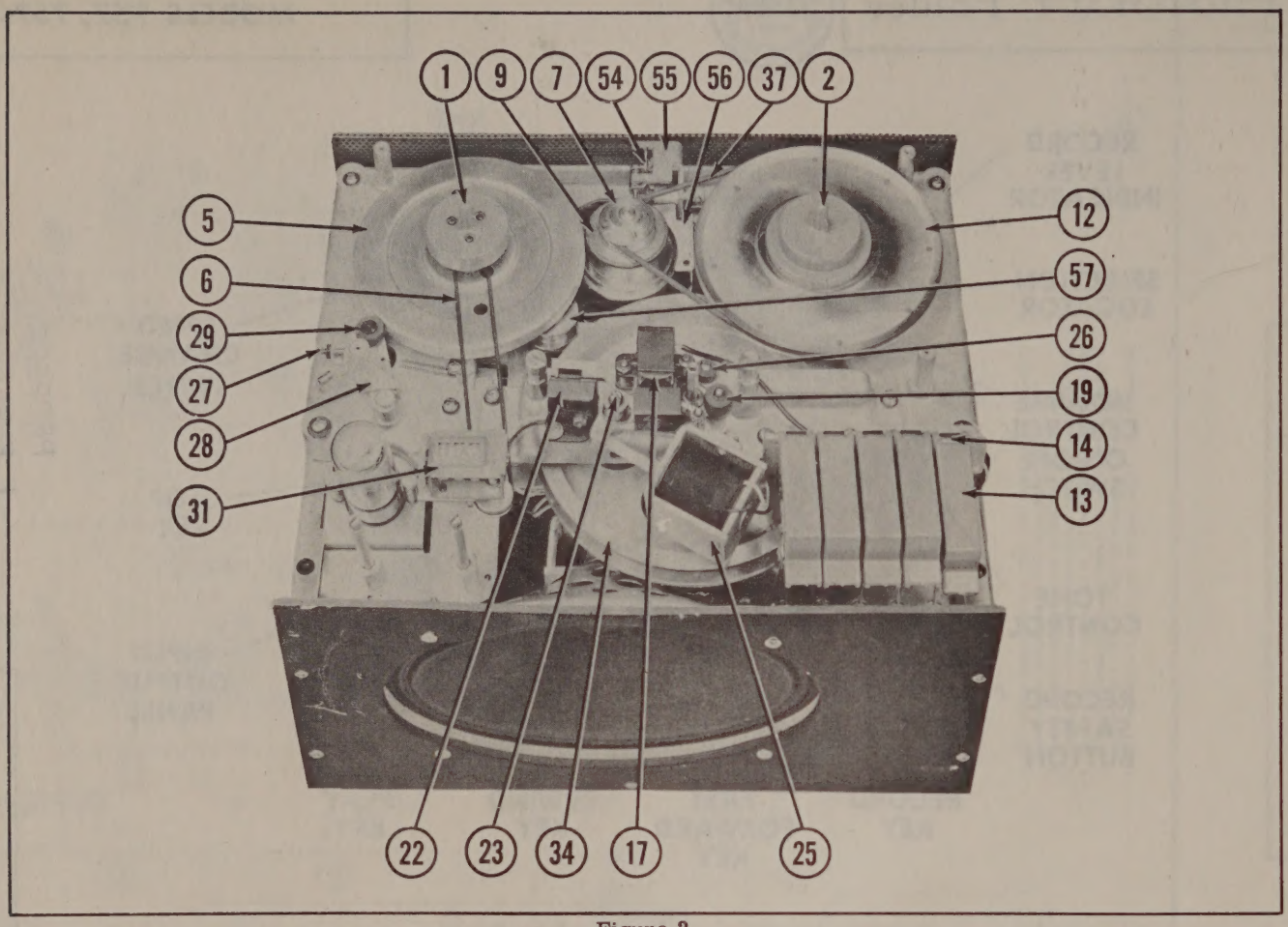

Figure 2

SPECIFICATIONS

Weight-
32 Lbs.

Size-
16 1/2 x 15 1/2 x 10 1/2 inches.

Reel Size-
Up to 7 inches.

Tracks-
Dual.

Track Selection-
Manual Turnover.

Tape Speed-
Model 757 - 3 3/4 and 7 1/2 I. P. S.
Model 757-A -

Recording Time-
3 3/4" Speed - 2 hours(1 hour each track).
7 1/2" Speed - 1 hour(1/2 hour each track).

Amplifier Tube Complement-
5879, 12AX7, 6AQ5, 6C4, 6E5.

Bias Frequency-
48KC ± 10KC.

Frequency Response-
3 3/4" Speed - 50 to 8500 cps.
7 1/2" Speed - 40 to 13000 cps.

Controls-
2 knobs, 5 piano-type keys.

CONTROL FUNCTIONS

Record Key- Tape starts instantly when this key is depressed. Key will not operate unless "Record Safety Button" is slid to left. Erase is automatic when "Record Key" is depressed, thus eliminating previous recordings on the tape.

Fast Forward Key- (Tape moves left to right.) Accelerated spindle speed quickly brings tape to desired index position for accurate editing or cueing.

Rewind Key- (Tape moves right to left.) Fast rewind integrated to selection locator. Even tension while rewinding prevents spillage of tape.

Play Key- Tape starts instantly. Provides for both visual and audio cueing.

Stop Key- Stops tape motion instantly. Stop key is interlocked with all other keys, requiring full stop of winding mechanism between functions. You must always return to "Stop" before pressing any of the other keys.

OPERATING INSTRUCTIONS

1. With the "On - Off Volume Control" in the "Off" position (extreme counterclockwise), insert the power cord plug into a convenient wall receptacle of the proper rating.

Threading The Tape-

1. Place a reel of tape on the left hand (supply) spindle so that the reel will turn counterclockwise when tape is pulled from the reel.

2. Place an empty reel on the right hand (take-up) spindle.

NOTE: When placing reels on spindles, be sure they are firmly seated on the reel-locking fins to insure positive motion of tape.

3. Unreel about two feet of tape and guide it through the recording slot. Glossy side of tape (Type "A" wind) must face outside of reel. (Dull side in.)

4. Feed the loose end of the tape up into the empty reel on the right hand spindle. Thread the tape into one of the slots in the outer surface of the hub. Hold the loose end between the fingers and slowly rotate this reel counterclockwise until all slack is taken up between reels.

To Record-

1. Connect microphone or any other type of input.

2. Switch on recorder by turning the "On-Off Volume Control" clockwise.

3. After waiting 30 to 60 seconds for the amplifier to warm up, slide "Record Safety Button" to the left and depress the "Record Key".

4. Adjust the "Volume Control" so that the "Recording Level Indicator" almost closes on loudest sounds (peak output). At the start of the recording set the "Selection Locator" at zero.

Selection Locator-

This odometer-type indicator registers "000" to "999" and will save much guess-work when trying to locate a desired portion of a pre-recorded tape. The reading of the indicator may be noted as the recording is being made so that reference to any given part on the tape may be made very rapidly. When a recorded tape has been so logged or referenced, always "zero" the indicator before starting to play the recording.

To Play Recordings-

1. With the "Stop Key" depressed, thread the tape as outlined under the heading "Threading The Tape".

2. Depress the "Play Key" and adjust the "Volume" and "Tone" controls for most pleasing reporduction.

3. Depress the "Stop Key" when finished.

Dual Track Recording-

Models 757 and 757-A are designed so that only 1/2 the tape width is recorded at a time, thereby resulting in two track recording. This two track operation is accomplished in the following manner:

1. After a reel of tape has been recorded; i.e. all the tape wound onto the right hand reel, depress the "Stop Key".

2. Remove the reels from the recorder, turning the full reel over and placing it on the left spindle.

3. Properly thread the tape and proceed with the recording.

4. After the second track has been recorded the first track of recording is ready to be played, without rewinding; by reversing the reels as described in Step #2 above.

To Edit And Splice Tape-

NOTE: Since it is impossible to edit and splice one track without affecting the other, recordings which are to be edited should be limited to one track only.

1. The tape may be edited by cutting out unwanted portions, or by joining selections into another sequence. Announcements may be inserted between selections, etc. Unused sections of tape can be spliced together for re-use.

2. Cut diagonally with an overlap so ends will line up. (Cutting tape on a diagonal will eliminate detection of splice on recording.

3. Align both ends of tape, uncoated or glossy side up.

4. Cover aligned ends with splicing tape. Press firmly, exerting pressure, to secure ends evenly and securely.

5. Trim off excess splicing tape. Cut into recording tape backing very slightly to eliminate possibility of a sticky splice.

Fast Forward And Fast Rewind-

High-speed forward or rewind can be obtained by pressing the desired key. These functions are used primarily in locating a desired portion of a recording in a few seconds.

NOTE: The "Stop Key" must always be depressed before changing functions.

To Use An External Speaker-

Any size speaker of the permanent magnet type, having a 3 to 8 ohm voice coil, may be used by connecting the alligator clips of the radio-phono cord across the voice coil terminals on the external speaker and then inserting the radio-phono cord plug into the receptacle marked "Ext. Speaker".

DESCRIPTION OF TAPE DRIVE MECHANISM

Primary Drive- The motor pulley (32) and driver unit (7 and 9) are mounted on the shaft of drive motor (50) and drives the flywheel and capstan assembly (34) by means of drive belt (33). The motor is controlled by the switch on the volume control.

Takeup Drive- The takeup belt (37) drives the takeup pulley (12) which in turn drives takeup spindle (2)

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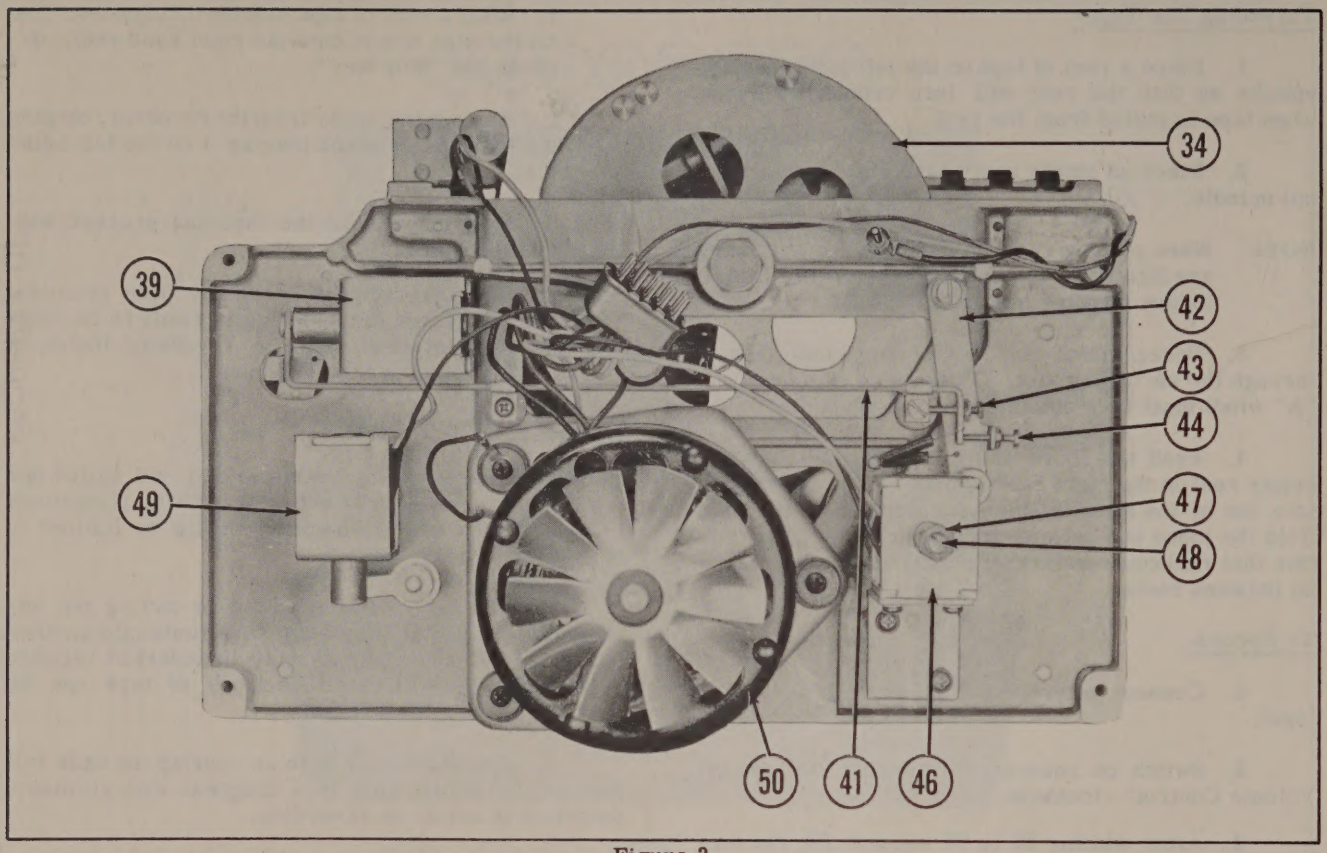

Figure 3

through action of takeup clutch (38). When any key except "Stop" is depressed the brake solenoid (39) is energized thereby releasing the takeup brake (42) and the feed spindle brake (29). When "Play" or "Rewind" is depressed the forward solenoid (46) is partially energized thereby pulling downward on the takeup spindle (2) and causing the spindle to be driven through the takeup clutch. When the "Fast Forward" key is depressed the forward solenoid (46) is fully energized thereby pulling downward on the takeup spindle (2) with sufficient force to virtually lock the spindle clutch producing a direct drive between the takeup pulley (12) and takeup spindle (2).

Rewind Drive- When either the "Record", "Fast Forward" or "Play" key is depressed the brake (29) is released and the feed spindle (1) is driven by the tape. Rotation of this spindle drives the counter assembly (31) by means of belt (6). When the "Rewind" key is depressed the rewind solenoid (49) is energized thereby swinging the feed spindle (1) toward the motor shaft causing the drum (5) to come in contact with the tire on the rewind driver (9). The rewind driver is driven through a clutch disc located between the driver and the flywheel drive pulley.

Pinch Roller- The pinch roller (19) is mounted on the pinch roller arm (20) which is pivoted on an eccentric stud (23). When either the "Play" or "Record" key is depressed the pinch roller solenoid (25) is energized thereby swinging the pinch roller over against the capstan. The head pad (18) is pivoted on the pinch roller arm so that, when the pinch roller presses the tape against the capstan, the head pad presses the tape against the head.

DISASSEMBLY INSTRUCTIONS

Removal of Panels-

1. Remove "Volume" and "Tone" control knobs. If knobs stick use a knob puller or slip the folded edge of a thin cloth under the edge of a knob and use the cloth as a puller.

2. Depress "Stop" key; then push record lock to the left and depress "Record" key. Loosen set screw in right-hand side of record lock knob and remove knob.

3. Remove the two screws at the front (operating side) corners of the plastic control panel.

4. Remove the four flat pan head screws which hold the metal panel in place.

5. Lift off the control panels.

Removal From Case-

1. Take off panels as described under "Removal of Panels".

2. If recorder is equipped with shipping locks, copper plated brackets located between the front corners of the cast mechanism plate and the sides of the case (these were not used on early production recorders), loosen the screws which hold the locks in place and remove the locks.

3. Place the recorder on its side and remove the six screws and finish washers from the bottom of the case. Slide the unit out of the case.

NOTE: Be careful not to damage the felt pad located between the speaker baffle and the case.

Removal Of Tape Drive Mechanism From Amp. Chassis-

1. Take out the four screws (located at corners of casting) which hold the drive unit to the chassis. Lift up the drive unit and disconnect the 14 contact motor and solenoid plug and the single contact head plug. Lift the drive unit out of the chassis.

MECHANICAL ADJUSTMENTS

Brakes-

Proper operation of brakes is essential to good tape handling. Improper adjustment can be expected to lead to either tape spilling or tape breakage, therefore, it is essential that brake adjustments be made in the sequence, manner and in the amounts specified. The adjustments are as follows:

1. Loosen the rewind brake adjusting screw (27) enough to prevent the ear on actuating arm (28) from moving the arm upon which the brake roller is mounted, even though the brake solenoid plunger is pushed in as far as it will go.

2. With the brake solenoid plunger pressed in as far as possible (apply pressure to end of plunger, not to operating bar) adjust the operating bar stop screw (44) to 1/16" clearance between the end of the screw and the stop stud.

3. With the plunger depressed, as described above, adjust the rewind brake adjusting screw (27) to produce a clearance 0.020 to 0.025" between the brake roller and the spindle drum (5).

4. Release the brake solenoid plunger, then adjust the takeup brake roller adjusting screw (43) to produce a clearance of 0.020" between the end of the screw and the operating bar (41).

5. Thread the recorder with tape and check operation of the feed spindle brake as direction is changed from "Fast Forward" to "Stop" to "Rewind". If the brake slips on the drum, loosen the retaining screw for the brake spring anchor bracket (30) and rotate the bracket in order to increase the pressure of the brake roller on the drum.

Forward Solenoid-

Loosen the locknut (47) and adjust screw (48) to produce a tape tension of approximately 2 oz. at the start of a 7" reel-tension at the end of a 7" reel should be approximately 1/2 oz. when operating in "Record" or "Play" position. When "Fast Forward" is in use the takeup spindle should be virtually locked to the takeup pulley. In "Rewind", the spindle may revolve slowly when loaded with an empty 7" reel. Should it be necessary to remove the solenoid, it must be located with respect to the end of the spindle when reassembling. Remove adjusting screw (48) and the spring, plunger and disk, then insert a depth gauge through the hole for the adjusting screw and locate the solenoid (vertically) so that the distance from the end of the spindle to the end of the bushing is 1.835".

Rewind Drive Clutch-

Locate the main drive pulley (32) so that the rewind drive tire (9) is above the bottom edge of the feed spindle drum (5). Place a 0.040" feeler gauge between the top surface of the rewind drive disc (9) and the takeup drive pulley (7) - (just under the edge of the pulley). Press down on the takeup drive pulley until it touches the guage, then tighten the set screws in the takeup drive pulley.

Pinch Roller Adjustments-

Improper adjustment of the pinch roller (19) usually produces one of the following troubles:

1. "Monkey Chatter" effects due to excessive tape velocity.

2. "Woofy" effects due to low tape velocity.

3. Sluggish operation of pinch roller arm when switching from "Play" or "Record" to "Stop" or vice-versa.

4. "Wows".

If the pinch roller (19) is not pressing the tape firmly against the capstan (34), either condition 1 or 2 will occur (depending upon the amount of tape on the takeup reel and the takeup tension of the unit under test).

If the pinch roller (19) is pressed too firmly against the capstan (34), operation of the pinch roller arm will be sluggish.

NOTE: Sticking of the plunger of the pinch roller solenoid can also cause sluggish operation - this condition can also cause "wows".

In order to insure proper adjustment of the pinch roller mechanism proceed as follows:

1. Loosen the retaining screw for the stop cam (26) and turn cam to the position allowing minimum travel of the pinch roller arm (20).

2. Loosen the retaining screws for the pinch solenoid (25) so that the solenoid can be moved on the bracket.

3. Energize the pinch solenoid by depressing either the "Play" or "Record" key.

4. Press down on the plunger of the pinch solenoid (25), in order to make sure that the plunger is seated, then move the solenoid in order to bring the end of the pinch roller arm (20) in contact with the stop cam (26).

NOTE: If the pinch roller (19) binds on the capstan (34) it will be necessary to rotate the pinch roller arm pivot stud (23). Before rotating the stud, loosen its lock screw which is located on front of the recording mechanism assembly (35).

5. Tighten the pinch solenoid (25) mounting screws. Check to make sure that the plunger slips freely in the solenoid.

6. Thread the recorder with tape and depress the "Play" key.

7. Rotate the pivot stud (23) until the pinch roller holds the tape against the capstan with just enough pressure to feed the tape when the takeup reel is stopped and also prevent the takeup reel from pulling the tape through the capstan and pinch roller. (Excessive takeup tension can aggrevate this condition.)

8. Tighten the pressure arm pivot stud lock screw.

9. Remove the tape, then depress the "Play" key. Loosen the stop cam (26) retaining screw and rotate the cam slightly. If the pinch roller arm moves toward the cam, this indicates that the solenoid plunger is not seating on its stop. Should this condition be encountered, loosen the pinch solenoid (25) mounting screws and move the solenoid toward the plunger link in order to bring the plunger in contact with the stop.

10. Reset the stop cam.

11. Recheck the operation of the pinch roller with tape.

Belt Replacement-

The selection locator drive belt (6) and takeup belt (37) can be lifted off of the pulleys and replaced. Should it be necessary to replace the main drive belt (33), remove the takeup belt (37), then remove the 4 screws located at the ends of the recording mechanism assembly (35) and lift off the assembly. Install the new belt and replace the assembly.

ELECTRICAL TESTS AND ADJUSTMENTS

Bias Current-

Disconnect the shield of the recording head cable at the terminal strip directly behind the head. Insert a non-inductive resistor (not over 10 ohms) between the cable shield and the terminal and connect a VTVM across the resistor (keep lead length as short as possible). Depress the "Record" key. The voltage across the resistor should indicate a bias current of 0.6 to 0.8 milliampers.

Record Current-

Using the same setup as indicated above, remove the oscillator tube (V5), then connect an audio oscillator to the mike jack. Set the oscillator to 1000 C.P.S. and adjust the recorder "Volume" control so that the level indicator eye just closes (be sure to keep the output of the oscillator low enough so that the recorder "Volume" control is advanced more than half-way. This will avoid any danger of overloading the input section of (V2). The voltage across the resistor should indicate a record current of 0.06 to 0.08 milliampers.

Solenoids-

1. Many factors enter into the design of a solenoid, however, after the design is completed most of these factors are fixed and are of no concern to the serviceman. The serviceman is concerned with the following factors which effect performance:

(a) Current.

(b) Shorted turns.

(c) Mechanical forces resisting the pull of the plunger.

(d) Friction in the path of the plunger.

2. Testing- The following procedures are recommended.

(a) Current- open either lead of the solenoid under test and insert a D.C. milliammeter, adjust applied line voltage to produce 125 volts across the coil. The current should be 40-49 milliampers.

(b) Pull test- With a D.C. voltage of 120 volts across the coil and the plunger withdrawn 1/8" (lifted 1/8" off the stop) the pull should be 1 lb. minimum.

(c) Mechanical forces resisting pull of the plunger- check for binding of mechanical parts.

(d) Friction in path of plunger - remove plunger and examine inside of the bobbin.

NOTE: Some trouble was encountered in early units from the adhesive used in the bobbin having crept out onto the inner surface of the bobbin. This has been corrected but if encountered in early units remove by scraping. There should be approximately .005" clearance between the bobbin and plunger, if any binding is noted or clearance is inadequate, increase the ID of the bobbin by sanding with #00 sandpaper wrapped around a dowel. Warning! If inside of bobbin is sanded, blow out any dust before inserting plunger. Any difficulty of this nature can be expected to have been restricted to early production models only.

Head Orientation And Azimuth-

Remove the recorder head assembly and loosen the head retaining nut (located on the threaded bushing through which the head cable passes) enough so that the head can be rotated slightly on the mounting bracket. Install the head assembly and thread the recorder with 1 mil azimuth tape. Connect an output meter across the speaker. Depress the "Play" key and make a rough azimuth adjustment by rotating the adjustment nut (16). Rotate the record head to obtain maximum output. Remove the head assembly and tighten the head adjusting nut. Replace the head and rotate adjusting nut (16) to obtain maximum output. Warning! Watch out for a false peak-due to the short wave length it is possible to obtain a low peak when the ends of the head gap are displaced from a position normal to the line of tape travel by 1/2 wave length.

Erase Head Adjustments-

In order to position the erase head so that the tape passes through the center of the gap, loosen the erase head retaining screw and swing the head sideways to the proper position. Tighten the retaining screw. In order to locate the head vertically, loosen the retaining nut on front of the head mounting bracket,

and raise or lower the head so that the top surface of the pole pieces are even with the top edge of the tape.

Switch Maintenance-

Switch contacts can be cleaned with alcohol or carbon tetrachloride. Lubricate with Vaseline.

LUBRICATION

Place a light film of "Lubriplate" on all pivots. Apply 2 drops of clock oil to each capstan shaft bearing. The motor bearings are equipped with wicks which should be oiled once a year or every 500 hours of operation, whichever occurs first. Use clock oil or light machine oil (pure mineral oil only). Felt clutch disks may be cleaned with carbon tetrachloride, dried and then saturated with a mixture of 50% Amproil and 50% cabron tetrachloride. After lubricating the recorder, wipe the capstan, belts, pinch roller, feed spindle drum and rewind driver with a cloth dampened with carbon tetrachloride in order to remove any oil which might have seeped onto these parts.

TROUBLE CHART

TROUBLE	PROBABLE CAUSES	REMEDY
Recorder does not operate - no shadow in level eye.	1. Damaged switch on volume control.	Replace.
	2. Thermal cut-out in motor open due either to overheating or damage.	Clear air intakes, vents, and check fan.
Recorder does not operate - shadow in level eye.	1. Damaged solenoid power supply.	Repair.
	2. Shorted or open brake solenoid.	Replace.
	3. Brakes improperly adjusted.	Adjust.
Intermittent tape drive.	1. Thermal cut-out is cycling due to overheating.	Clean air intakes, vents, and check fan.
Motor runs - capstan does not revolve.	1. Damaged flywheel drive belt.	Replace.
	2. Flywheel drive belt off of pulleys.	Place on pulleys and check alignment.
	3. Capstan shaft binding.	Align bearings.
Takeup spindle does not revolve in "Play" or "Forward".	1. Damaged spindle drive belt.	Replace.
	2. Spindle solenoid plunger loose or improperly adjusted.	Adjust and tighten.
	3. Forward solenoid open.	Replace.
Takeup spindle revolves slowly in "Forward".	1. Forward solenoid improperly adjusted.	Adjust.
	2. Forward solenoid partially shorted.	Replace.
Feed spindle does not revolve in "Rewind".	1. Open solenoid.	Replace.
	2. Spindle arm is sticking.	Free the mechanism.
	3. Rewind driver clutch slipping.	Adjust.
Feed spindle turns clockwise to all running positions of keys.	1. Spindle arm is sticking.	Free the mechanism.
	2. Arm return spring is broken.	Replace.
	3. Solenoid plunger is sticking.	Free the plunger.
Tape winds loosely on takeup reel.	1. Warped reel.	Replace.
	2. Insufficient takeup tension.	Adjust.
Tape breaks on change from "Play" or "Record" to "Rewind".	1. Rewind driver clutch too tight.	Adjust clutch.
	2. Feed spindle brake improperly adjusted (slack tape).	Adjust brakes.
	3. Pinch roller operation is sluggish.	Check adjustment and check plunger clearance.

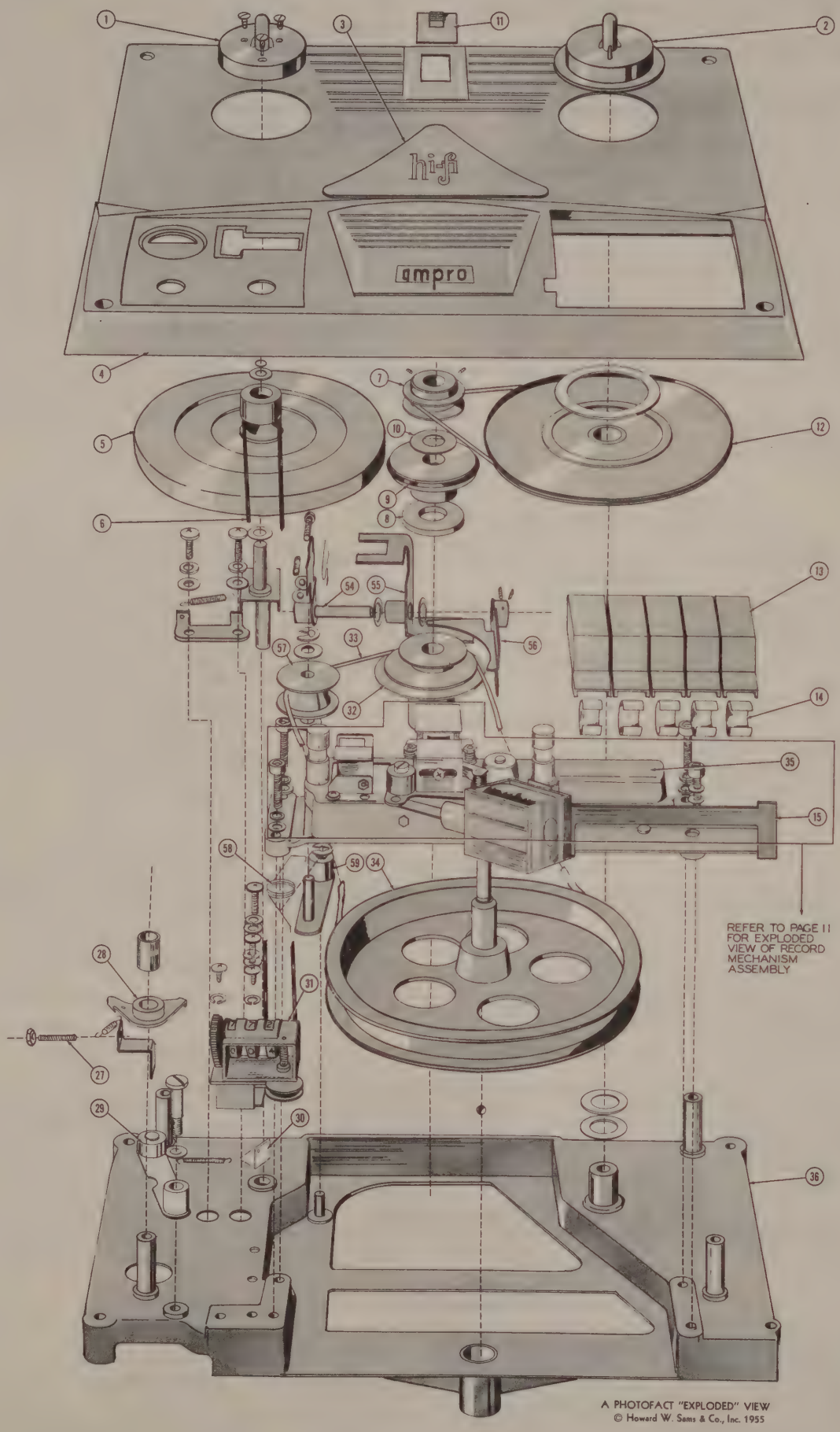
hi-fi
ampro
REFER TO PAGE 11 FOR EXPLODED VIEW OF RECORD MECHANISM ASSEMBLY
A PHOTOFACT "EXPLODED" VIEW
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Figure 4A. Exploded View Of Parts Above Baseplate.

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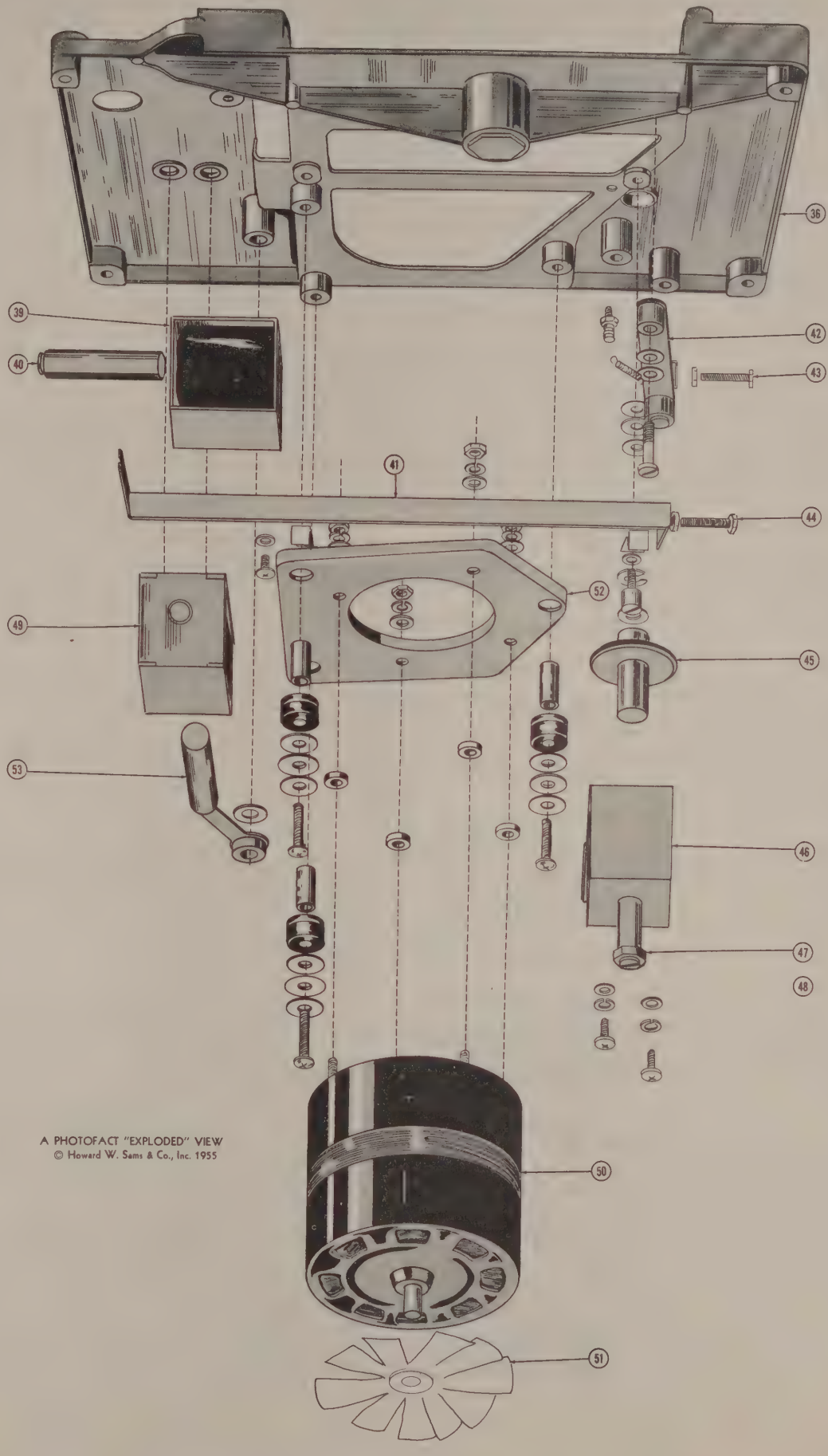


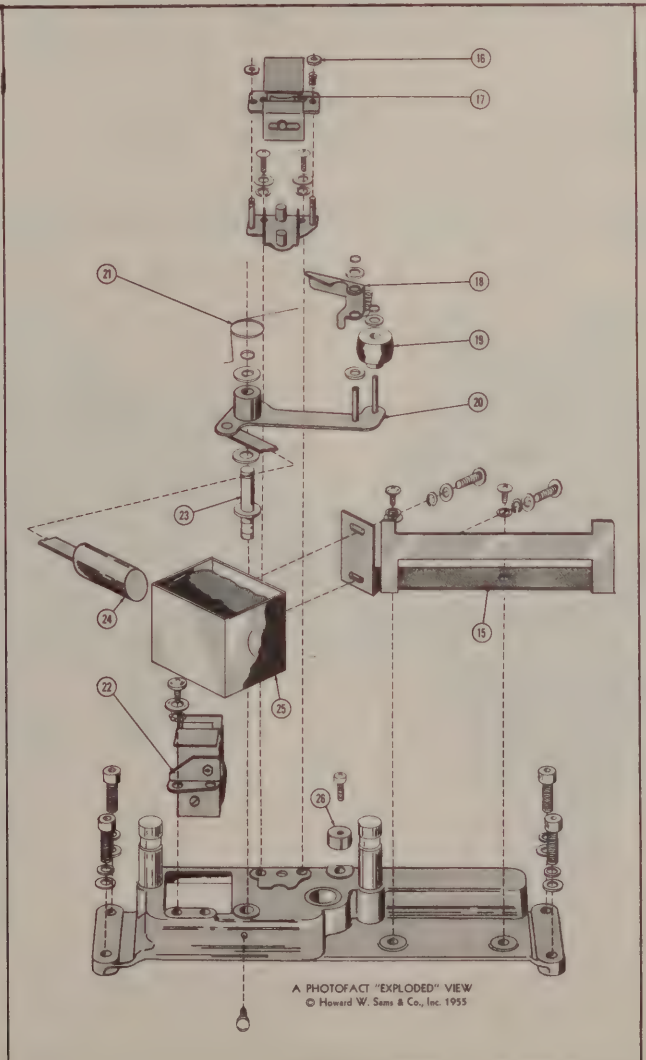
Figure 4B. Exploded View Of Parts Below Baseplate.

TROUBLE CHART - Con't.

TROUBLE	PROBABLE CAUSES	REMEDY
Tape breaks on change from "Play" or "Record" to "Forward".	1. Feed spindle brake improperly adjusted (slack tape).	Adjust brakes.
	2. Pinch roller operation is sluggish.	Check adjustment and check plunger clearance.
Tape breaks on change from "Rewind" to "Forward".	1. Takeup spindle brake improperly adjusted.	Adjust brakes.
Tape rewound edgewise on feed reel.	1. Warped reel.	Replace.
	2. Erase head out of line.	Reposition.
	3. Rewind driver clutch too tight.	Adjust.
	4. Brakes improperly adjusted (slack tape).	
Pitch of sound too high or too low.	1. Inadequate pressure on pinch roller.	Adjust.
	2. Pinch solenoid plunger sticking.	Adjust.
	3. Pinch solenoid open.	Replace.
Keys stick.	1. Mounting bracket misaligned.	Re-align.
	2. Key slipped off of switch plunger.	Re-align.
	3. Control panel mis-aligned.	Re-align.
Keys thump on up stroke.	1. Rubber cushion missing from control panel.	Replace cushion.
Selection locator (counter) does not operate.	1. Damaged belt.	Replace.
	2. Belt off of pulleys.	Reposition belt.
	3. Control panel mis-aligned.	Re-align.
Buzzing noises.	1. Takeup belt oscillating (occured only in early models).	Exchange takeup drive pulley.
	2. Loose speaker grille.	Tighten.
	3. Loose case hardware.	Tighten.
Squeal on starting.	1. Capstan bearings out of line.	Re-align.
Rubbing noises.	1. Warped reel.	Replace.
	2. Flywheel slipped on shaft (rough handling).	Press flywheel shaft back to correct position and stake.
Inadequate clearance for threading.	1. Erase head out of line.	Re-align.
	2. Pressure pad in too far.	Bend detent to produce proper clearance.

ELECTRICAL AND SOUND TROUBLE CHART

TROUBLE	PROBABLE CAUSES	REMEDY
Amplifier squeals.	1. Broken shield at head connector.	Re-solder.
Crashing noises.	1. Damaged tubes.	Replace.
	2. Dirty switch.	Clean
Pitch of sound too high or too low.		See Mechanical trouble.
"Wows".	1. Pinch roller pressing too hard against capstan.	Re-adjust.
"Flutter".	1. Bent capstan shaft.	Replace capstan and flywheel assembly.
Loud tape hiss.	1. Very low recording level.	Record at correct level.
	2. Damaged erase head.	Replace head.
Will not record or play back.	1. Dirty recording head.	Clean.
Incomplete erasure.	1. Erase head not properly positioned.	Re-align.
	2. Damaged erase head.	Replace head.
	3. Excessive recording level.	Run tape thru erase process several times.



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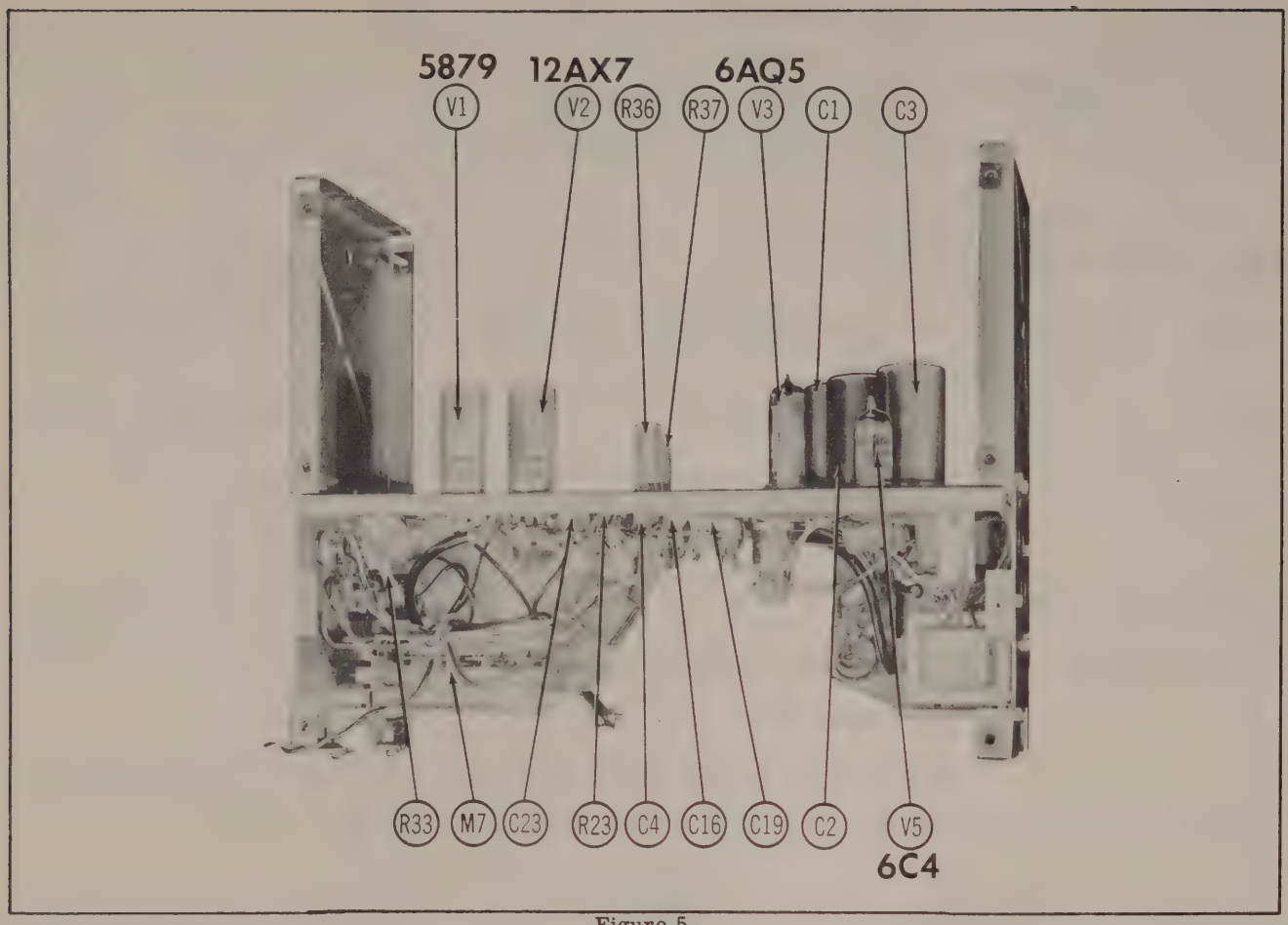

Figure 5

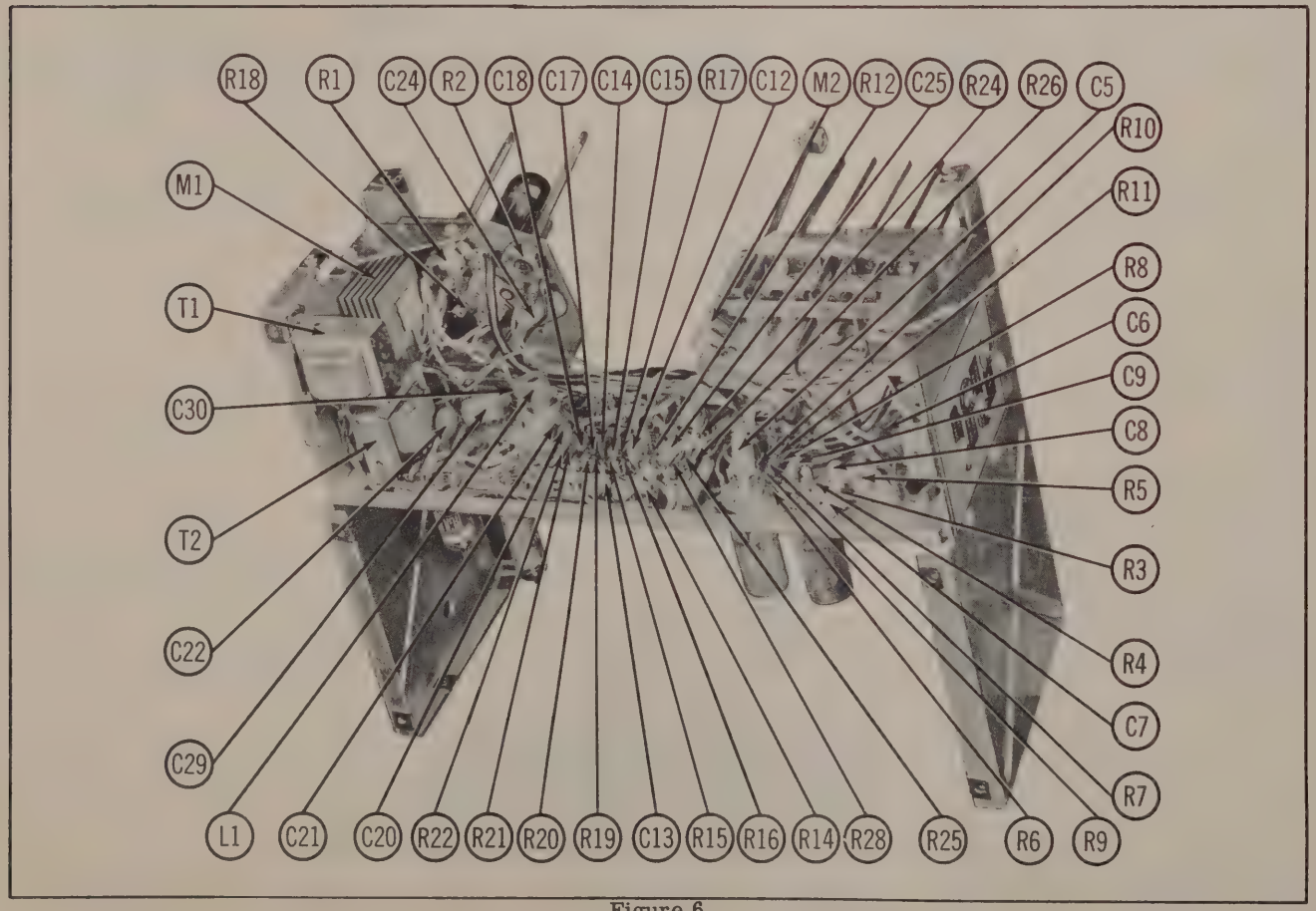

Figure 6

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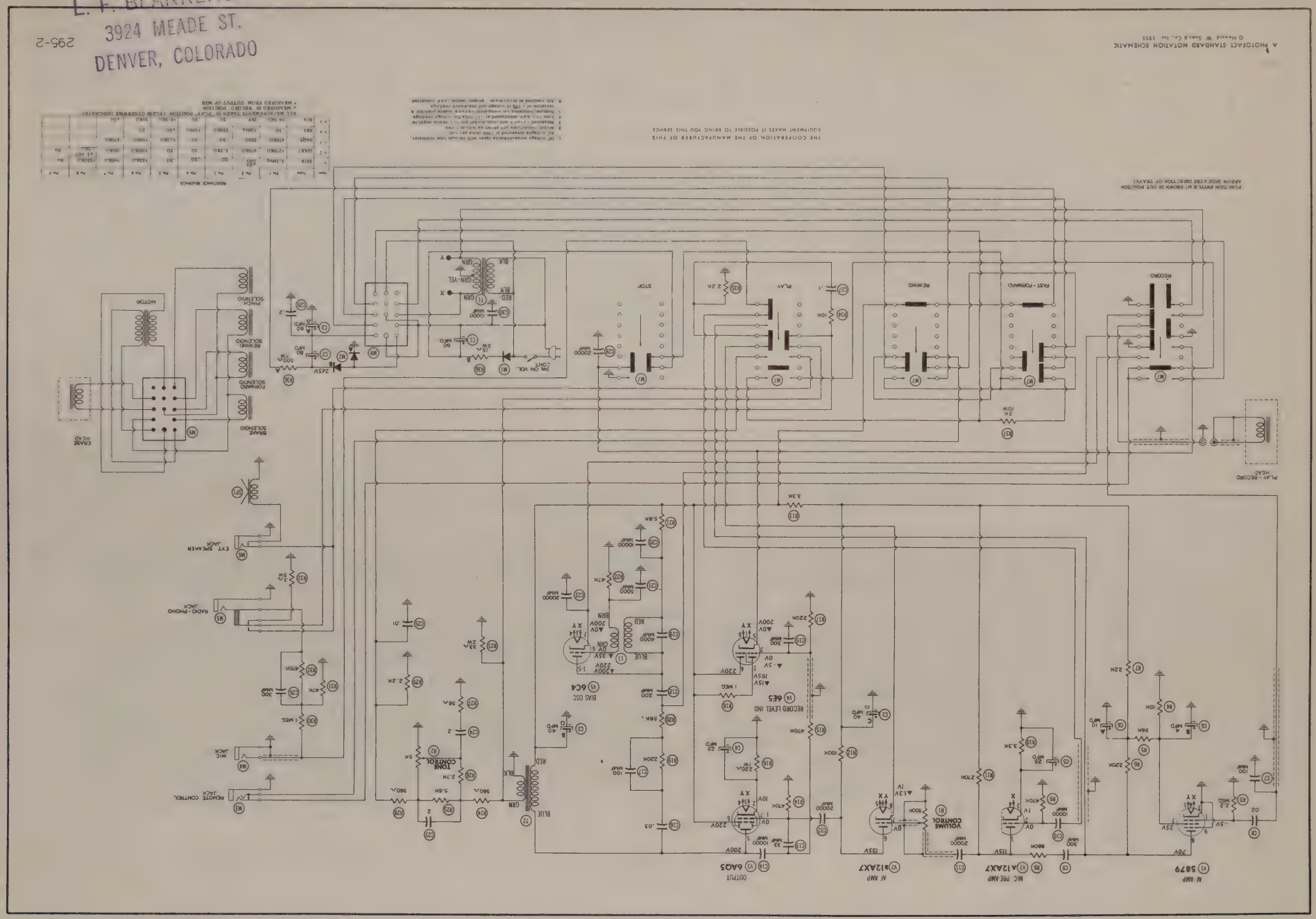

ELECTRICAL PARTS LIST

Ref. No.	Part No.	Description
V1	18797	5879, AF Amp.
V2	18497	12AX7, Mic. Pre-Amp. & A. F. Amp.
V3	18701	6AQ5, Output
V4	18985	6E5, Record Level Ind.
V5	18978	6C4, Bias Osc.
C1	18491	Elect. Cap. 80MFD. @150V.
C2	18491	Elect. Cap. 80MFD. @150V.
C3A	18981	Elect. Cap. 80MFD. @150V.
C3B		Elect. Cap. 40MFD. @250V.
C3C		Elect. Cap. 40MFD. @250V.
C4	18486	Elect. Cap. 25MFD. @15V.
C5	18486	Elect. Cap. 25MFD. @15V.
C6A	17111	Elect. Cap. 10MFD. @200V.
C6B		Elect. Cap. 4MFD. @200V.
C7	18830	Cap., Ceramic, 100MMF
C8	18579	Cap., Molded Paper, .02MFD @150V.
C9	17110	Cap. Ceramic, 300MMF .
C10	18487	Cap. Ceramic, 10000MMF .
C11	17107	Cap., Ceramic, 20000MMF.
C12	17107	Cap., Ceramic, 20000MMF.
C13	17119	Cap., Ceramic, 33MMF.
C14	18487	Cap., Ceramic, 10000MMF.
C15	17110	Cap., Ceramic, 300MMF.
C16	17751	Cap., Molded Paper, .05MFD. @400V.
C17	18493	Cap., Ceramic, 100MMF.
C18	17126	Cap., Ceramic, 200MMF.
C19	18867	Cap., Mica, 4000MMF.
C20	18487	Cap., Ceramic, 10000MMF
C21	18488	Cap., Ceramic, 5000MMF.
C22	17107	Cap., Ceramic, 20000 MMF.
C23	17109	Cap. Molded Paper, .2MFD. @150V.
C24	17109	Cap., Molded Paper, .2MFD. @ 150V.
C25	17129	Cap., Molded Paper, .01MFD. @200V.
C26	17110	Cap., Ceramic, 300MMF.
C27	17108	Cap., Molded Paper, .1MFD. @ 150V.
C28	17107	Cap., Ceramic, 20000MMF.
C29	17109	Cap., Molded Paper, .2MFD. @150V.
C30	18487	Cap., Ceramic, 10, 000MMF.
R1	18986	Volume Control & Switch Assy. 500K
R2	18975	Tone Control, 5K
R3	18465	Resistor, 2. 2Meg. @1/2 W.
R4	17553	Resistor, 10K@1/2 W.
R5	17965	Resistor, 56K@1/2 W.
R6	17959	Resistor, 220K@1/2 W.
R7	18583	Resistor, 22K@1/2 W.
R8	17099	Resistor, 680K@1/2 W.
R9	18474	Resistor, 470K@1/2 W.
R10	18466	Resistor, 3. 3K@1/2 W.
R11	18468	Resistor, 270K@1/2 W.
R12	18470	Resistor, 100K@1/2 W.
R13	18466	Resistor, 3. 3K@1/2 W.
R14	18474	Resistor, 470K@1/2 W.
R15	18474	Resistor, 470K@1/2 W.
R16	18719	Resistor, 220Ω@1 W.
R17	17959	Resistor, 220K@1/2 W.
R18	17558	Resistor, 1Meg. @1/2 W.
R19	17959	Resistor, 220K@1/2 W.
R20	17965	Resistor, 56K@1/2 W.
R21	18470	Resistor, 5. 6K@1/2 W.
R22	17555	Resistor, 47K@1/2 W.
R23	18771	Resistor, 33Ω@2 W.
R24	18610	Resistor, 560Ω@1/2 W.
R25	18470	Resistor, 5. 6K@1/2 W.
R26	18582	Resistor, 2. 7K@1/2 W.
R27	17127	Resistor, 56Ω@1/2 W.
R28	18610	Resistor, 560Ω@1/2 W.
R29	18472	Resistor, 2. 2K@1/2W.
R30	17558	Resistor, 1 Meg. @1/2 W.
R31	17555	Resistor, 47K@1/2 W.
R32	18474	Resistor, 470K@1/2 W.
R33	18718	Resistor, 3Ω@5 W.
R34	17553	Resistor, 10K@1/2 W.
R35	18472	Resistor, 2. 2K@1/2 W.
R36A	75709	Resistor, 500Ω@5 W. (Terminals 1 & 2)
R36B		Resistor, 15Ω@5W. (Terminals 3 & 4)
R37	75710	Resistor, 2K@10W.
T1	75708	Filament Transformer, 6. 3V.
T2	18989	Output Transformer
L1	17100	Oscillator Coil
SP1	75603	Speaker
M1	17091	Selenium Rect. -MA250
M2A	17103	Selenium Rect. -MA65
M2B	17103	Selenium Rect. -MA65
M3	17084	Remote Control Jack
M4	17085	Mic. Jack
M5	17083	Radio-Phono Jack
M6	18597	Ext. Speaker Jack
M7	75704	Push-Button Switch
M8	18982	14 Prong Connector Socket
M9	18979	14 Prong Connector Plug

Ref. No.	Part No.	Description
1	75103-1	Rewind Reel Support
2	75943-X	Take-up Reel Spindle Assembly
3	75601-3	Head Trim Cover (Model 757-A uses Part #75601-4 in this application)
4	75965	Front and Rear Cover Assembly
5	75915	Rewind Wheel Assembly
6	75615	Counter Drive Belt
7	75266	Rewind Spindle Drive Pulley
8	16211	Felt Washer
9	75912	Rewind Driver Assembly
10	75339	Spring Washer
11	75636-1	Speed Change Knob
12	75916	Fast Forward Pulley Assembly
13	75602	Operating Keys
14	75500	Operating Key Springs
15	75326	Sol. and Key Mtg. Bracket
16		#6-40 Head Adjusting Nut
17	75702	Play-Record Head
18	75905	Pressure Pad Arm Assembly
19	75908	Pinch Roller Assembly
20	75909	Pinch Roller Arm
21	75501	Pinch Roller Arm Spring
22	75925	Erase Head Assembly
23	75212	Pinch Roller Arm Pivot
24	75218	Pinch Solenoid Plunger
25	75918-1-X	Pinch Solenoid Assembly
26	75226	Pinch Roller Arm Stop
27	141078	Rewind Brake Adj. Screw #6-32 x 1/2"
28	75934-X	Rewind Brake Lever Assembly
29	75927	Rewind Brake Arm Assembly
30		Brake Spring Anchor Bracket

Ref. No.	Part No.	Description
31	75608	Selection Locator
32	75257	Main Drive Pulley
33	75613	Flywheel Drive Belt
34	75977	Flywheel Assembly
35	75940-X	Record Mechanism Assembly
36	75106	Main Frame
37	75616	Takeup Drive Belt
38	16219	Spindle Clutch Washer-Felt
39	75918-X	Brake Solenoid Assembly
40	75219	Brake Solenoid Plunger
41	75926	Brake Operating Bar Assembly
42	75933	Take-up Reel Brake Arm Assy.
43	141026	Take-up Brake Adj. Screw - #6-32 x 3/4"
44	141026	Operating Bar Stop Screw- #6-32 x 3/4"
45	75911	Spindle Solenoid Plunger Assy.
	16212	"O" Ring Tire for Item 45
46	75919	Spindle Solenoid Assembly
47	141056	Solenoid Jam Nut -#5/16-24
48	75241	Take-up Adj. Screw
49	75918-X	Rewind Solenoid Assembly
50	75703	Drive Motor
51	131342	Motor Fan
52	75327	Motor Mounting Plate
53	75252	Rewind Solenoid Plunger
54	75969	Control Lever and Shaft Assy.
55	75970	Shifter Mtg. Bracket
56	75966-X	Shifter Lever and Tab Assy.
57	75988	Idler Pulley Assy.
58	75514	Take-up Lever Spring
59	75976	Pulley and Takeup Assy.

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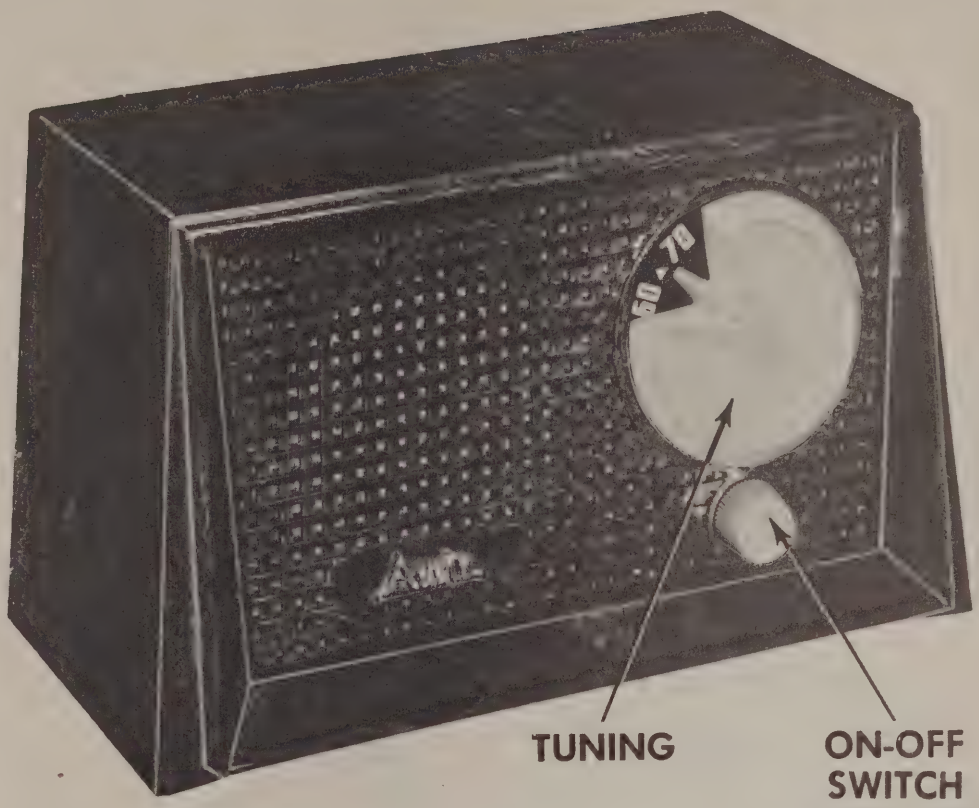
ARVIN MODELS
950T, 951T (Ch. RE391)



ARVIN MODELS
950T, 951T (Ch. RE391)

TRADE NAME	Arvin Model 950T, 951T (Ch.RE391)
MANUFACTURER	Arvin Industries, Inc., Columbus, Ind.
TYPE SET	AC-DC Operated AM Superheterodyne Receiver
TUBES (Five)	Types 12BE6 Conv., 12BA6 IF Amp., 12AV6 Det.-AVC-AF Amp., 50C5 Output, 35W4 Rectifier
POWER SUPPLY	105-125 Volts AC-DC RATING .21 Amp. @ 117 Volts AC
TUNING RANGE—BROADCAST	540KC-1600KC

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.
Loop should be maintained in same relative position to chassis as when receiver is in cabinet.
Use isolation transformer, if available. If not, connect a .1MFD capacitor in series with low side of signal generator and B-.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1.	.05MFD	High side to pin 7 (grid) of 12BE6 (V1). Low side to B-.	455KC (400~ Mod.)	Tuning gang fully open.	Across voice coil.	A1, A2, A3, A4	Adjust for maximum output.
2.	"	"	1600KC	"	"	A5	"
3.		Loop (Radiated)	1000KC	Tune to 1000KC signal.	"	A6	Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output.

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PARTS LIST AND DESCRIPTIONS

ARVIN Model 950T

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: ARVIN PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	Converter	12BE6	12BE6	7CH	
V2	IF Amp.	12BA6	12BA6	7BK	
V3	Det.-AVC-AF Amp	12AV6	12AV6	7BT	
V4	Audio Output	50C5	50C5	7CV	
V5	Rect.	35W4	35W4	5BQ	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: ARVIN PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C1A	■50	150		FP311	TM-3011	T-295	
B	▲30	150					
C	20	25					

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: ARVIN PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	NOTES
C2	20000			DD-203	817-02		
C3	20000			DD-203	817-02		
C4A	220						
B	2000						
C	5000		♦	♦PC-150	♦1408-01		
D	250						
E							
C5	10000			DD-103	811-01	DC5U	
C6	20000			DD-203	817-02		
C7	20000			DD-203	817-02		

♦ Items C4A, C4B, C4C, C4D, C4E, R5A, R5B and R5C are combined in one unit. When replacing items separately, C4D and C4E should total 250MMF.

CONTROLS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	REPLACEMENT DATA: ARVIN PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1	500K	½	C43094					Volume & Switch

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: ARVIN PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R2	22KΩ	⅛		BTS-22K	
R3	68Ω	⅛		BTS-68	
R4	2.2Meg	⅛		BTS-2.2Meg	

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: ARVIN PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R5A	6.8Meg	⅛		BTS-6.8Meg	
B	470KΩ	⅛	♦	BTS-470K	
C	470KΩ	⅛		BTS-470K	
R6	120Ω	½		BTS-120	
R7	1200Ω	1		BTA-1200	

♦ Items C4A, C4B, C4C, C4D, C4E, R5A, R5B, R5C are combined in one unit.

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE: PRI.	IMPEDANCE: SEC.	REPLACEMENT DATA: ARVIN PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T1	2.4KΩ	3.3Ω	Part of SPKR	Z1101	A-3025	A-3332	26S58 ①	S-12X	① Drill one new mounting hole.

SPEAKER

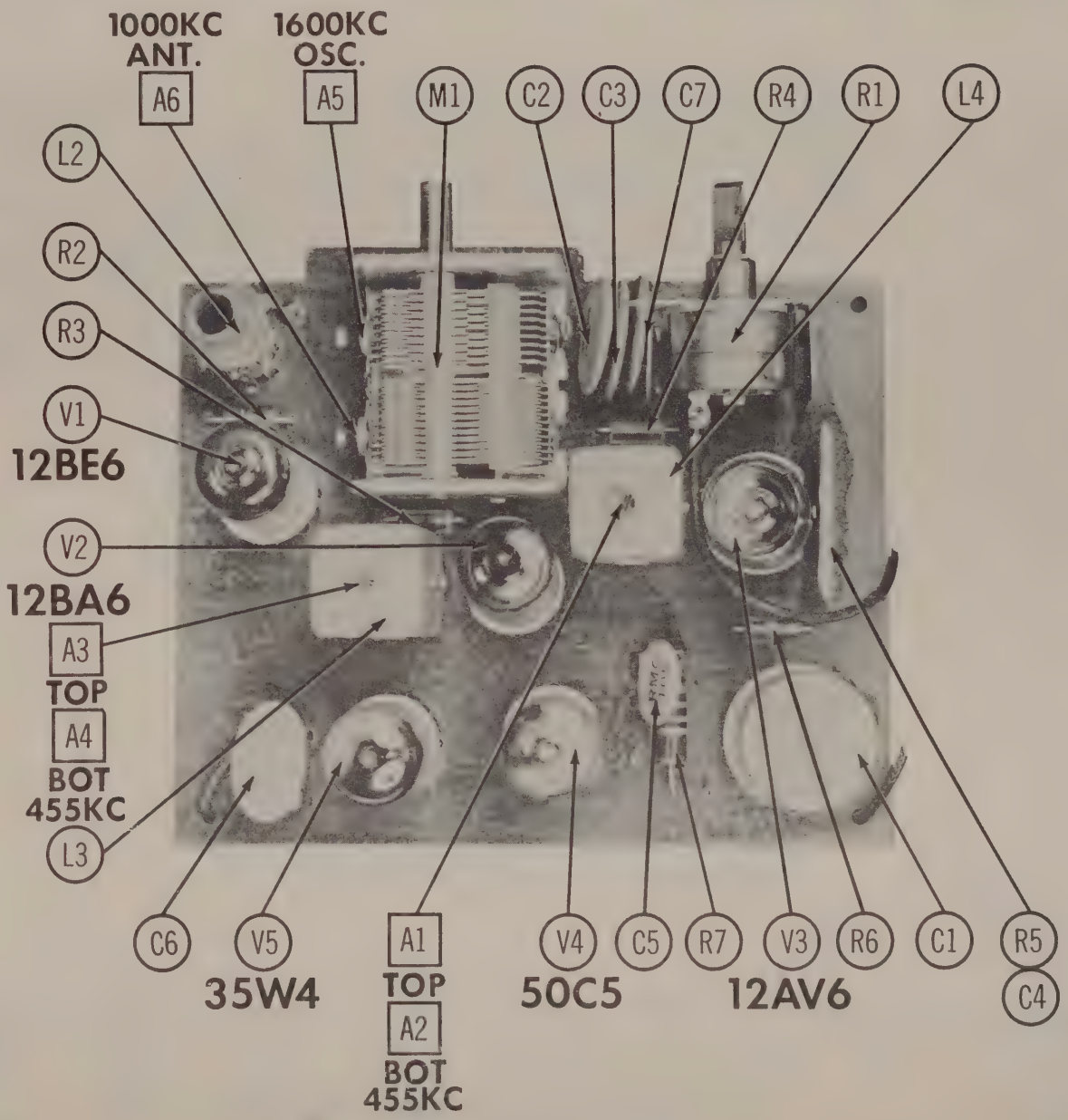
ITEM No.	RATINGS: SIZE	RATINGS: FIELD	RATINGS: V. C. IMP.	REPLACEMENT DATA: ARVIN PART No.	QUAM PART No.	NOTES
SP1	4"	PM	3.3Ω	C43096	4A07	

COILS (RF-IF)

ITEM No.	USE	DC RES.: PRI.	DC RES.: SEC.	REPLACEMENT DATA: ARVIN PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	Loop Ant.	3.5Ω						Includes cabinet back.
L2	Osc. Coil	.7Ω	8Ω					
L3	Input IF	15Ω	15Ω	C43042	16-6758	BC-352	13-PC1	
L4	Output IF	15Ω	15Ω	C43042	16-6758	BC-353	13-PC2	

MISCELLANEOUS

ITEM No.	PART NAME	ARVIN PART No.	NOTES
M1	Tuning Cap.	D43095	2 Gang



CHASSIS TOP VIEW

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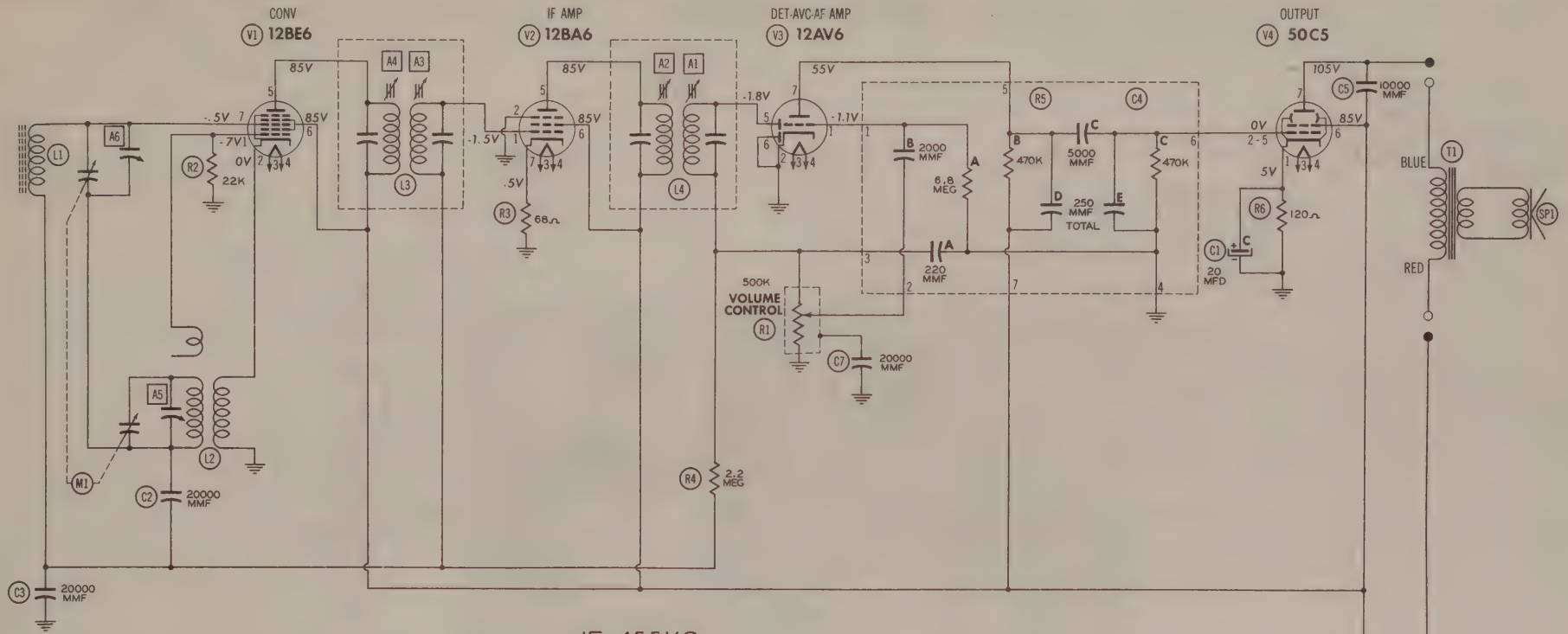
ARVIN
Model 950T

SET 295 FOLDER 3



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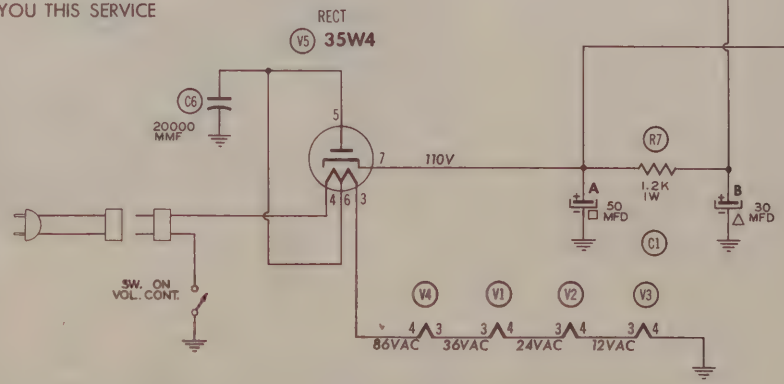

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V 1	12BE6	22KΩ	.5Ω	36Ω	24Ω	†1.2KΩ	†1.2KΩ	2.7Meg
V 2	12BA6	2.7Meg	0Ω	24Ω	12Ω	†1.2KΩ	†1.2KΩ	68Ω
V 3	12AV6	6.8Meg	0Ω	12Ω	0Ω	500KΩ	0Ω	†47KΩ
V 4	50C5	120Ω	470KΩ	36Ω	86Ω	470KΩ	†1.2KΩ	†180Ω
V 5	35W4	NC	NC	86Ω	121Ω	112Ω	112Ω	50KΩ

†MEASURED FROM PIN 7 OF V5.
NC-NO CONNECTION.

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.

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CBS-COLUMBIA MODELS
22CX1, 2, 3, 4, 22TX1, 2 (Ch. 1601, 2)

MODEL 22TX1

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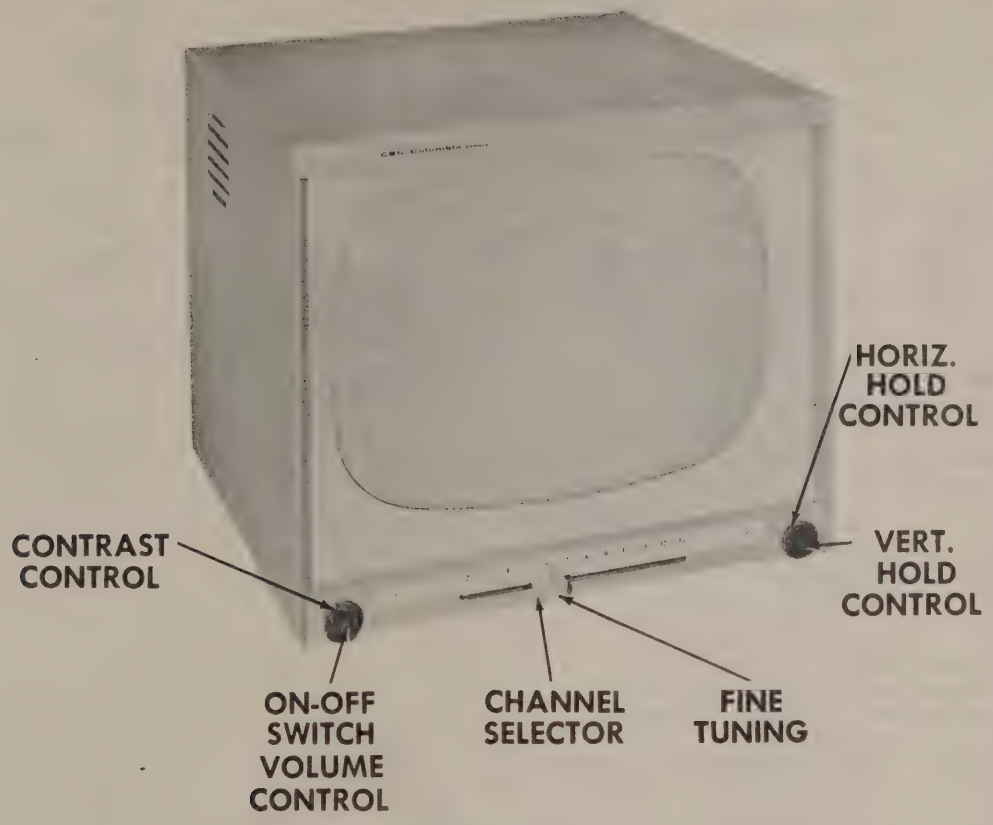

CBS-COLUMBIA MODELS
22CX1, 2, 3, 4, 22TX1, 2 (Ch. 1601, 2)

CBS-COLUMBIA 22TX1

TRADE NAME	CBS-Columbia	MODELS	CHASSIS
		22CX1, 22CX2, 22TX1, 22TX2	1601
		22CX3, 22CX4	1602
MANUFACTURER	CBS-Columbia, A Division of Columbia Broadcasting System, Inc., 48-50 34th. St., Long Island City 1, N.Y.		
TYPE SET	Television Receiver		
TUBES	Fifteen		
POWER SUPPLY	110-120 Volts AC-60 Cycle	RATING 1.28 Amp. @ 117 Volts AC	
TUNING RANGE	Channels 2 thru 13, Video IF 45.75MC, Sound IF 41.25MC (Intercarrier)		

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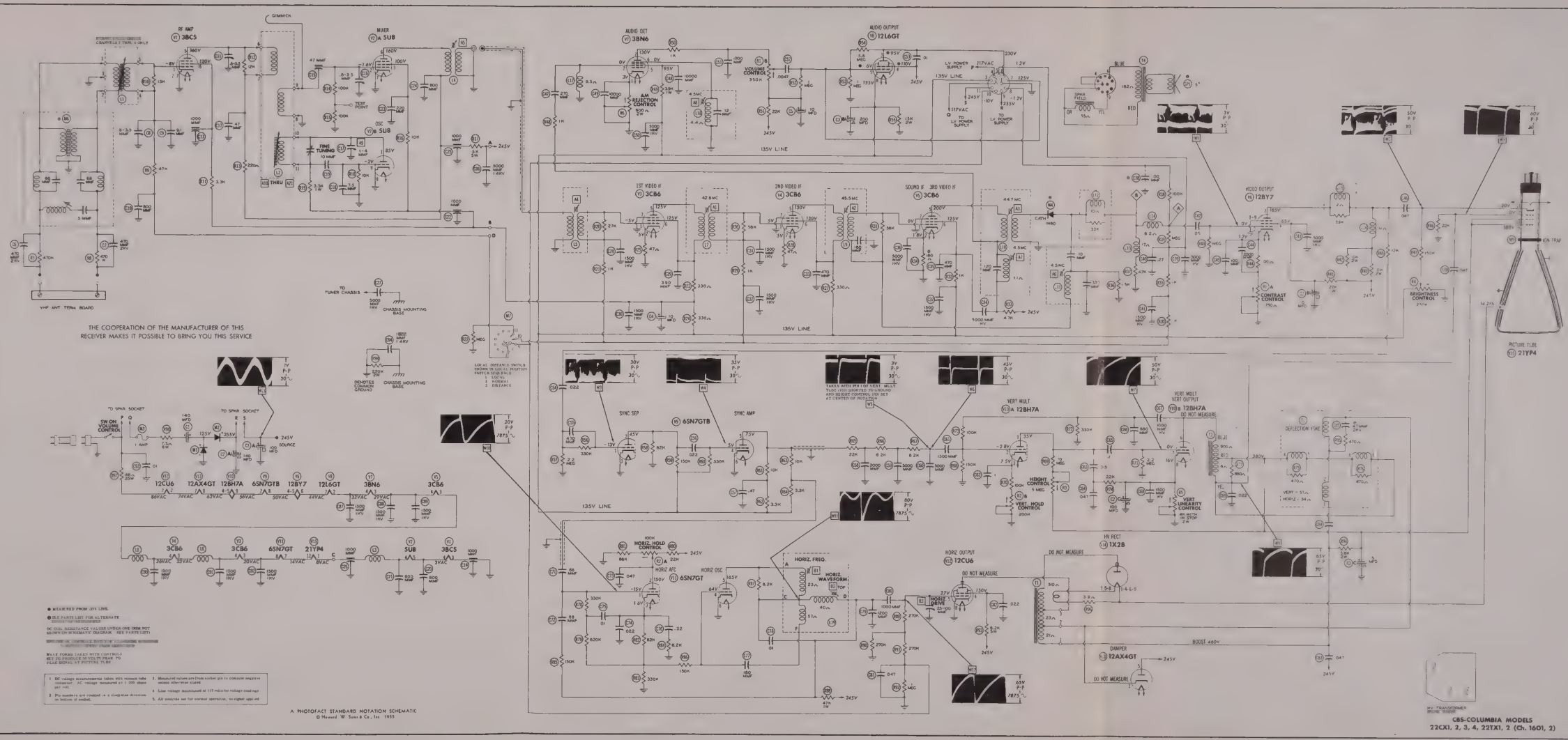
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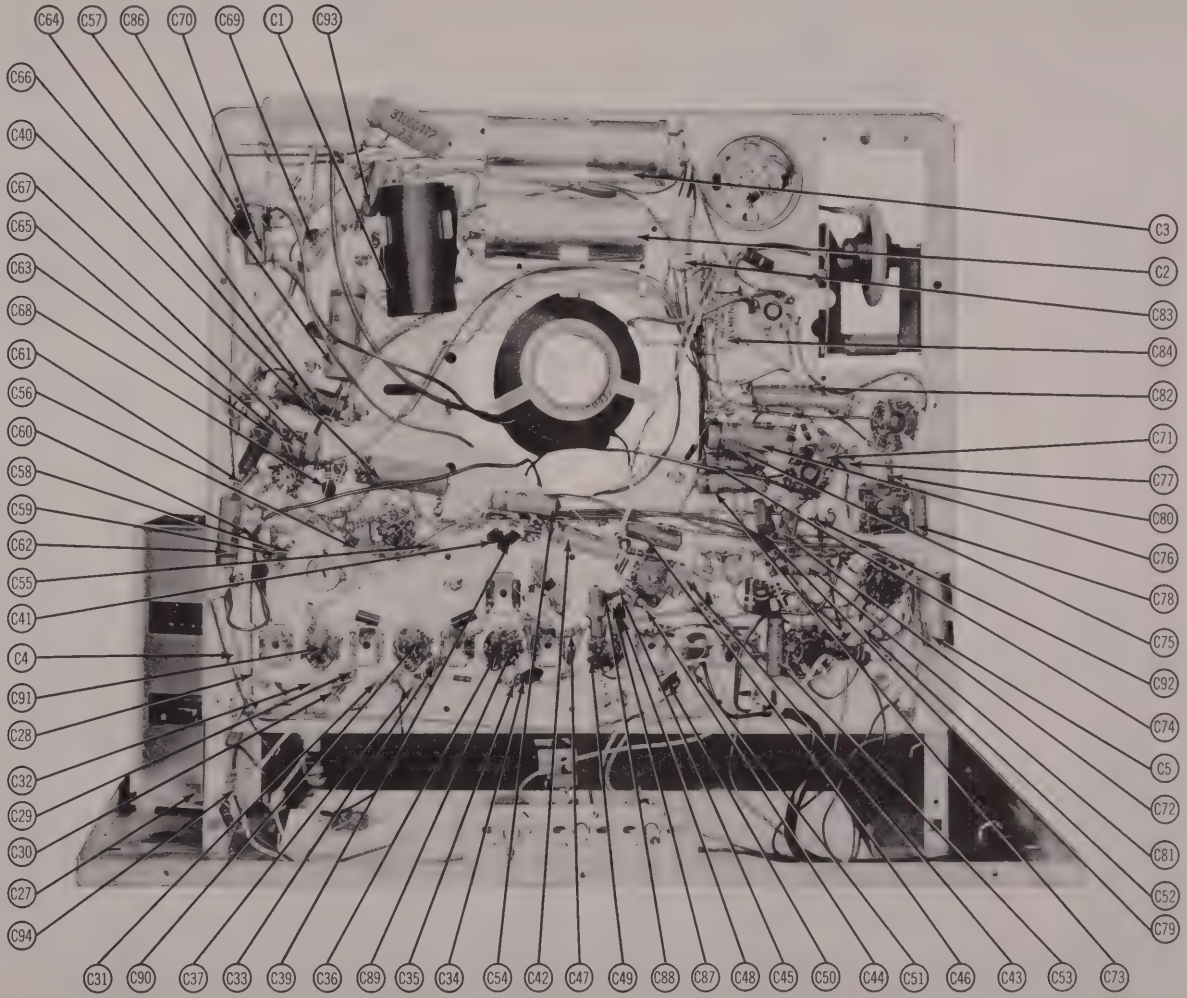
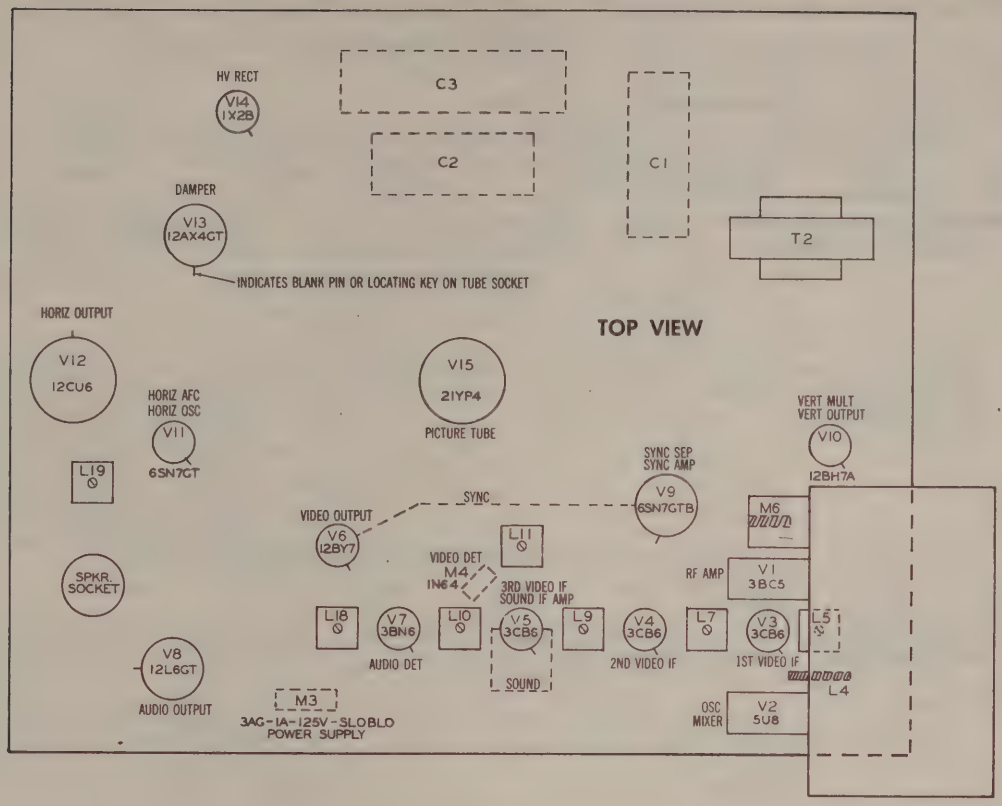
CBS-COLUMBIA MODELS 22CX1, 2, 3, 4, 22TX1, 2 (Ch. 1601, 2)

CHASSIS TOP VIEW



CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

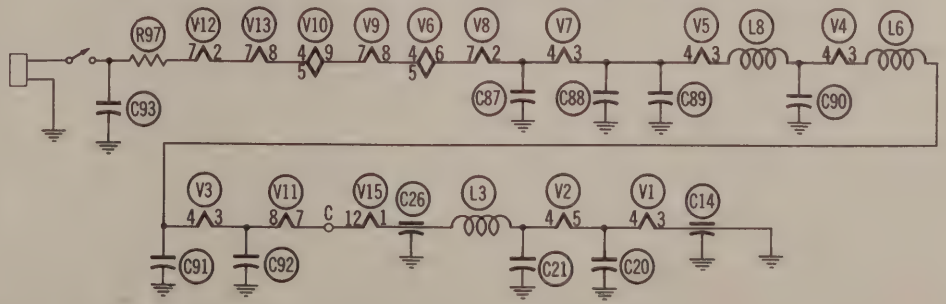
POWER SUPPLY FAILURE
No raster, no sound - Selenium Rectifiers (M1 & M2), Fuse (M3)

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V2, V3, V4, V5, V8
No pic, no sound, has snow - V1, V2, V3
No pic, has sound, has raster - V6, V15
Has pic, no sound - V7, V8

SYNC FAILURE
No vert. sync - V9, V10
No horiz. sync -V9, V11
No vert. or horiz. sync - V9

SWEEP FAILURE
No raster, has sound - V11, V12, V13, V14, V15
No vertical deflection - V10
Poor vert. linearity or foldover - V10
Poor horiz. linearity or foldover - V11, V12, V13
Narrow picture - V11, V12, V13, V14, M1, M2
Vert. off freq. - V9, V10
Horiz. off freq. - V9, V11

NOTE: Since this receiver employs tubes used in series filament network, an open filament in any tube in series may cause the set to be inoperative. (See circuit below).



CBS-COLUMBIA MODELS
22CX1, 2, 3, 4, 22TX1, 2 (Ch. 1601, 2)

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Use an isolation transformer to protect the test equipment.
The high voltage shock hazard may be eliminated by disconnecting the ground lead from pin 8 (cathode) of the horizontal output tube (V12).

VIDEO IF ALIGNMENT

Set the channel selector switch between any two channels. This will disable the local oscillator and reduce the possibility of erroneous indications.
Set the local-normal-distance switch in normal position.
Connect the negative lead of a 3 volts battery to the ungrounded side of C32.
Connect the positive lead to chassis.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	.001MFD	High side to pin 1 (grid) of 3CB6 (V3). Low side to chassis.	Not used	42.8MC (Unmod)	Between any two channels	Use VTVM. DC probe to point (A). Common to chassis.	A1	Adjust for maximum deflection. Attenuate generator to maintain 3 volts on VTVM.
2.	"	"	"	45.5MC	"	"	A2	"
3.	"	"	"	44.7MC	"	"	A3	"
4.	Direct	High side to an ungrounded tube shield floating over converter tube (V2). Low side to chassis.	43MC (10MC Swp)	42.65MC 45.75MC	"	Vert. Amp. to point (A). Low side to chassis.	A4, A5	Adjust A4 and A5 for response curve similar to Fig. 1. If necessary increase bias to -4 volts at ungrounded side of C32. If necessary, retouch A1, A2 and A3 for correct marker positions and correct tilt. A1 affects low frequency side of response curve and position of 42.65MC marker. A2 affects high frequency side of response curve and position of 45.75MC marker. Retouch A3 for maximum amplitude and MINIMUM tilt.

SOUND IF ALIGNMENT USING AM AND FM SIGNAL GENERATOR AND VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
5.	Direct	High side to point (B). Low side to chassis.	4.5MC (30%Mod)	Between any two channels	AC probe thru .01MFD to pin 3 (plate) of 12L6 (V8). Common to chassis.	A6, A7	Attenuate generator output for lowest usable indication on VTVM. Adjust for maximum deflection.
6.	"	"	4.5MC (25KC Div)	"	"	A8	Increase signal output for usable indication. Adjust A8 for maximum deflection.
7.	"	"	4.5MC (30% Mod)	"	"	R6	Adjust the AM rejection control (R6) for MINIMUM deflection on VTVM. Repeat steps 5, 6 and 7 until best results are obtained.

SOUND IF ALIGNMENT USING ON THE AIR SIGNAL

Remove bias battery. Turn set on and tune in a strong TV station. Turn the AM rejection control (R6) at is mid-range position.
Reduce the signal strength into the receiver by inserting an attenuator in series with the antenna and receiver antenna terminals. If a suitable attenuator is not available, remove the antenna from the antenna terminals and stray feed the signal into the receiver by placing the antenna near the antenna terminals. Attenuate station signal until a hiss is heard in the speaker.
Adjust A6 and A7 for maximum volume. Reconnect antenna and adjust A8 for maximum volume and minimum buzz. Attenuate signal until hiss is heard and adjust R6 for MINIMUM noise. Reconnect antenna and readjust A8 for maximum volume.

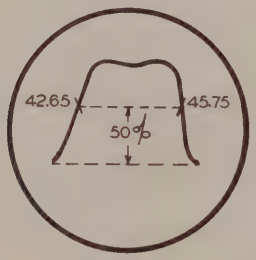


FIG. 1

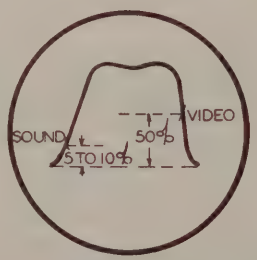


FIG. 2

ALIGNMENT INSTRUCTIONS (cont)

VHF OSCILLATOR ALIGNMENT

Connect bias as under "Video IF Alignment".
Note: Adjustment of A9 not in tuner #69000641.
In tuner part #69000631 complete oscillator alignment may not be necessary. If the oscillator seems to be off frequency approximately the same amount for a majority of the channels it may be possible to correct them in one step using A9.
It should be noted that this is an all channel oscillator circuit adjustment and should not be used to correct any individual channel. If adjustment A9 will not bring all channels well within the range of the fine tuning control it will be necessary to adjust the channel strip adjustment screw for each channel that is off frequency. The channel oscillator adjustment screws are reached thru a hole in the receiver bottom chassis below tuner.
The correct adjustment screw is accessible thru this hole as the channel selector is turned to each channel.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
8.	Two 120Ω Carbon Resistors	Across VHF antenna terminals with 120Ω in each lead.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. Amp. to point (A). Low side to chassis.	A10	Adjust to place sound marker in correct position as in Fig. 2. Video marker should be at 50%.
			207MC (10MC Swp)	205.25MC 209.75MC	12		A11	
			201MC (10MC Swp)	199.25MC 203.75MC	11		A12	
			195MC (10MC Swp)	193.25MC 197.75MC	10		A13	
			189MC (10MC Swp)	187.25MC 191.75MC	9		A14	
			183MC (10MC Swp)	181.25MC 185.75MC	8		A15	
			177MC (10MC Swp)	175.25MC 179.75MC	7		A16	
			85MC (10MC Swp)	83.25MC 87.75MC	6		A17	
			79MC (10MC Swp)	77.25MC 81.75MC	5		A18	
			69MC (10MC Swp)	67.25MC 71.75MC	4		A19	
			63MC (10MC Swp)	61.25MC 65.75MC	3		A20	
			57MC (10MC Swp)	55.25MC 59.75MC	2		A21	

ALTERNATE OSCILLATOR ADJUSTMENT

Tune in all VHF stations available and check each one to see if the fine tuning control can be tuned at a point where clearest picture and best sound occur. If the fine tuning control does not have sufficient range on any VHF channel strip set the fine tuning control to its mid-range position and then adjust the channel strip adjustment screw for clearest picture and best sound. Refer to "VHF oscillator Alignment"instructions for location of adjustment screws.

VHF RF AND MIXER ALIGNMENT

The RF and mixer portion of receiver has been properly aligned at the factory and is very stable. Alignment of this portion is not recommended in the field.

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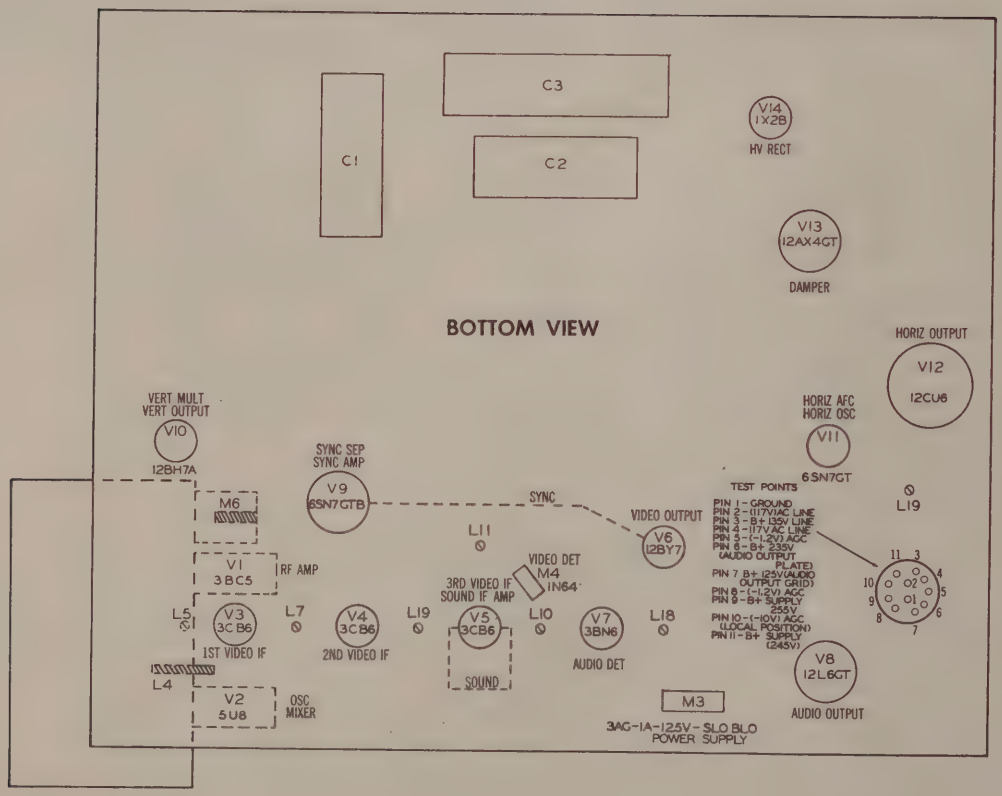
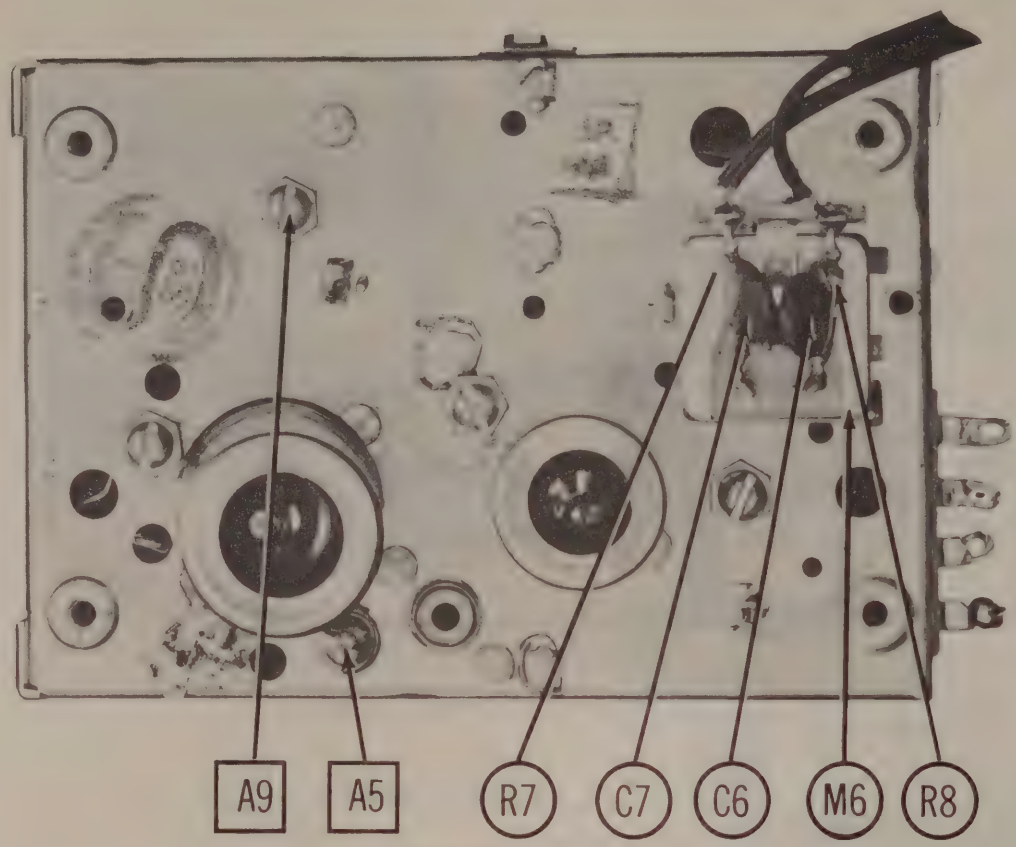
RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	3BC5	1Meg	0Ω	0Ω	1Ω	†5. 3KΩ	■3. 3KΩ	0Ω		
V 2	5U8	■3. 6Ω	200KΩ	■10KΩ	2Ω	1Ω	†5KΩ	0Ω	0Ω	10KΩ
V 3	3CB6	1Meg	47Ω	5Ω	6Ω	■660Ω	■660Ω	0Ω		
V 4	3CB6	1Meg	47Ω	6Ω	7Ω	■330Ω	■330Ω	0Ω		
V 5	3CB6	1. 5KΩ	180Ω	7Ω	8Ω	†4. 7KΩ	■1KΩ	0Ω		
V 6	12BY7	220Ω	1Meg	0Ω	13Ω	13Ω	11Ω	†5KΩ	†27KΩ	0Ω
V 7	3BN6	300Ω	9. 5Ω	8Ω	9Ω	■3. 9KΩ	4. 4Ω	†375KΩ		
V 8	12L6GT	TP	9Ω	†240Ω	†55Ω	500KΩ	TP	11Ω	15KΩ	
V 9	6SN7GTB	2. 5Meg	■70KΩ	0Ω	350KΩ	■7KΩ	0Ω	14Ω	13Ω	
V 10	12BH7A	▲10Meg	120KΩ	140KΩ	16Ω	16Ω	▲6. 5KΩ	2. 2Meg	1. 3KΩ	14Ω
V 11	6SN7GT	1. 5Meg	†60KΩ	400KΩ	500KΩ	†47KΩ	0Ω	4Ω	5Ω	
V 12	12CU6	NC	19Ω	NC	†8. 2KΩ	500KΩ	TP	21Ω	0Ω	TOP CAP ▲23Ω
V 13	12AX4GT	NC	NC	2Meg	NC	†55Ω	NC	19Ω	16Ω	
V 14	1X2B		PINS	1-8	HAVE	INF	RESISTANCE			TOP CAP ▲535Ω
V 15	21YP4	2Ω	22KΩ	PIN 6 ▲5. 6KΩ	PIN 10 ▲5. 6KΩ	PIN 11 ■200KΩ	PIN 12 4Ω			

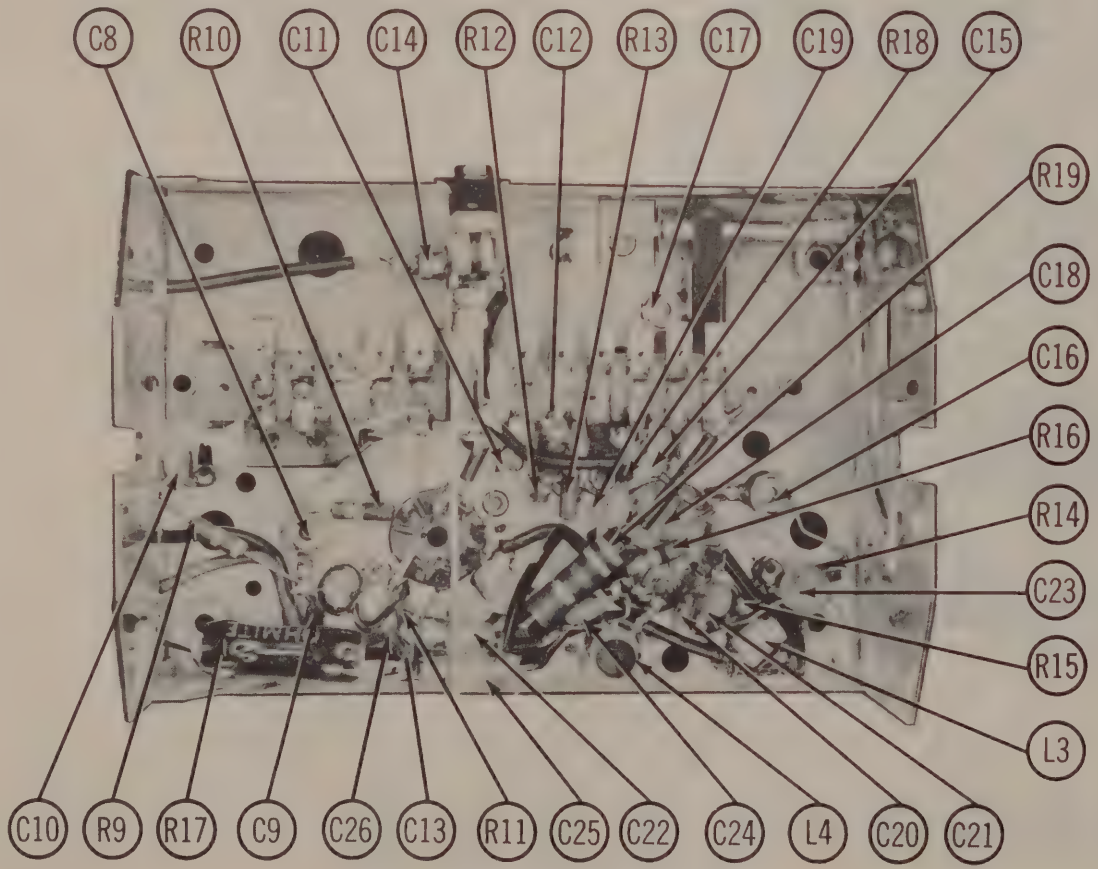
†MEASURED FROM OUTPUT OF M2.
■MEASURED FROM 135V LINE.
▲MEASURED FROM PIN 3 OF V13.
NC-NO CONNECTION.
TP-TIE POINT.



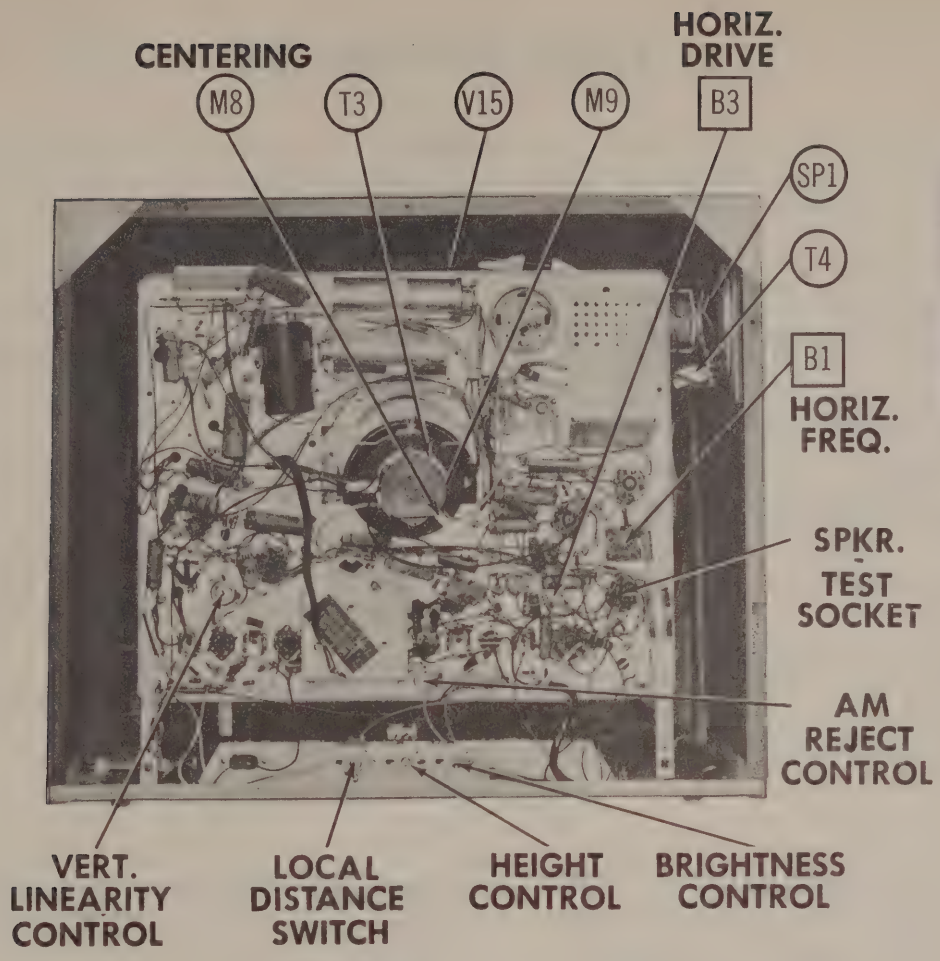
TUBE PLACEMENT CHART



RF TUNER-TOP VIEW



RF TUNER-BOTTOM VIEW



CABINET—REAR VIEW

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HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern. Set contrast control for a normal picture.

Set the horizontal hold control to its mid-range position.

Connect a short clip lead across terminals "C" and "D" of L19. Adjust the horizontal frequency slug (B1) until the picture synchronizes horizontally.

Remove the short from terminals "C" and "D" of L19.

Connect the vertical amplifier of an oscilloscope thru a 10MMF to terminal "C" of L19. Adjust the horizontal waveform slug (B2) until waveform similar to Fig. 3 is obtained.

Remove the oscilloscope connection and set the horizontal hold control maximum counter clockwise. Adjust the horizontal frequency slug (B1) until picture falls out of sync. If necessary momentarily remove signal by switching off channel and back again to lose sync. There should be approximately 12 diagonal bars present on the screen when picture falls out of sync.

In weak signal areas the horizontal hold control should be adjusted so that when switching on and off channels the picture returns completely in sync.

In normal signal areas the picture should fall out of sync only near the extreme clockwise and counter clockwise positions of the horizontal hold control when switching off channel and back again.

Decrease the contrast control to obtain a washed out picture. Adjust the horizontal drive trimmer (B3) counter clockwise until a vertical white line or compression appears on the screen (near the center). Then turn B3 clockwise until the vertical white line or compression just disappears.

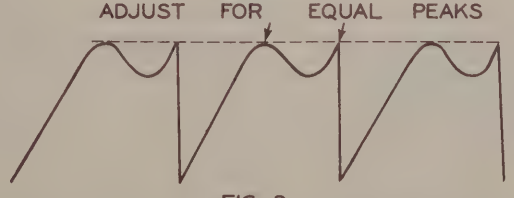


FIG. 3

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OFS SWEEP

Follow procedure outlined under "Loss of High Voltage."

INSUFFICIENT SWEEP

Check by substitution V12 and V13. Check M1 and M2. Check adjustment B3. Check R93, R98, C1, C80, T1, T3A and other associated components.

DRIVE LINES

Check by substitution V12 and V13. Check adjustment B3. Check C80, R88, R93, R97, R98 and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V12 and V13. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines".

PIE CRUST EFFECT

Check by substitution V11, V12 and V13. Check C74 and C76 for open. Check L19, R80, R86 and other associated components.

XMAS TREE EFFECT

Check by substitution V11, V12 and V13. Check T1 and T3 for internal arcing. Check C72, C77, C78, L19, R87 and other associated components.

VERTICAL

LOSS OF SWEEP

Substitute V10. Check waveform W7.

If Satisfactory	If Unsatisfactory
Check T2, T3B, C69, C68, C2C, R74 and other associated components.	Check C61, C62, C63, R69, R70, R3 and other associated components.

INSUFFICIENT SWEEP

Substitute V10. Check height and vertical linearity controls for proper operation. Check R69, T2 and other associated components.

COMPRESSED AT BOTTOM

Substitute V10. Check R3, R69, R72, R73, C65 and other associated components.

COMPRESSED AT TOP

Substitute V10. Check R5, R74, C68, C2C, T2, T3B, and other associated components.

FOLDS

Substitute V10. Check C63, C64, C65, R74, T2, T3B and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Substitute V9. Check C54, C55, C56, C57, R58, R59, R63, R64 and other associated components.

LOSS OF VERTICAL SYNC-HORIZONTAL SYNC SATISFACTORY

Substitute V10. Check vertical integrator network. Check C61, C62, C67, R2B, R70 and other associated components.

LOSS OF HORIZONTAL SYNC-VERTICAL SYNC SATISFACTORY

Substitute V11. Check C71, C74, C76, R84, R80, R2A, L19 and other associated components.

HORIZONTAL BENDING

Check by substitution V9 and V11. Check components. associated with V11.

VIDEO

LOSS OF VIDEO

Substitute V6. Check C42, C43, C46, R41, R42, R43, L16 and other associated components.

SOUND BARS (4.5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check video IF alignment.

POOR CONTRAST

Substitute V6. Check C42, C46, L12, L15, R42, R43 and other associated components.

NEGATIVE PICTURE

Substitute V6. Check picture tube. Check L12, L14, L15, C42, C46 and other associated components.

SMEAR

Substitute V6. Check L12, L13, L14, L15, R42, R43, C42, C46 and other associated components.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V1, V3, V4, V5 and V6 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V7 and V8. Check stage V8 using audio signal generator. Apply audio signal across C51.

If Satisfactory	If Unsatisfactory
Check audio detector and audio IF stages for component failure or change of value.	Check C51, C52, C53, C5, C3B, R52, R55, R51 and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustments A8 and R6 for minimum buzz. If still unsatisfactory, check audio IF alignment.

DISTORTED

Follow procedure outlined under "Weak or no Sound."

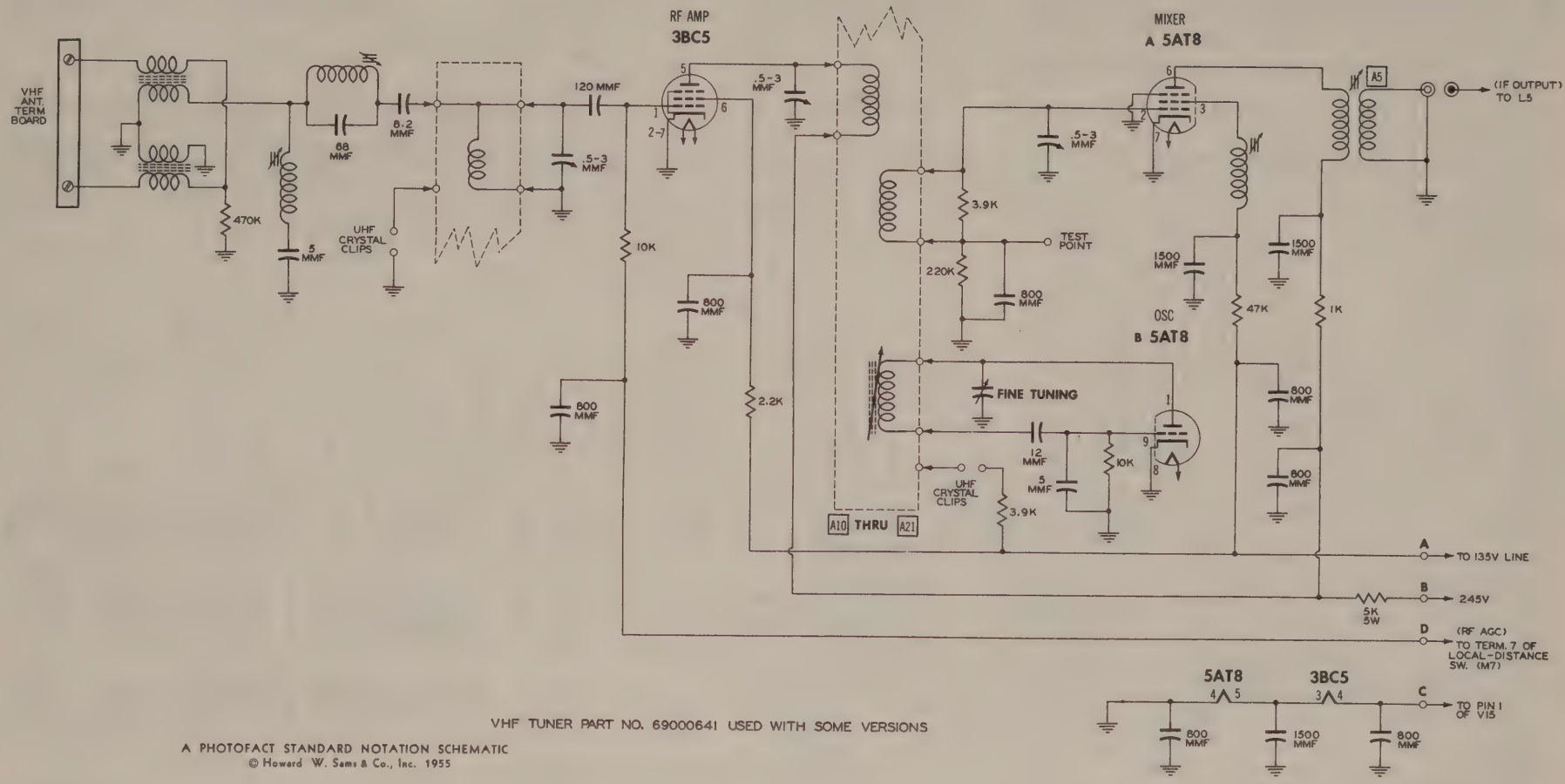
POWER

DEAD SET

If filaments fail to light, check AC interlock assembly. Check all tubes. These tubes are connected in series. Check switch on volume control and R97. If filaments light, check M3, M1, M2, C1 and R98. Check speaker plug. Check B+ filter and decoupling network.

SMALL AND /ON DIM PICTURE

Check M1, M2, R98 and C1. Check B+ filter and decoupling network.



VHF TUNER PART NO. 69000641 USED WITH SOME VERSIONS

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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PROPERTY OF
L. F. DAMMEIER SHOP
1845 MAPLE ST.
DENVER, COLORADO

ALTERNATE TUNER SCHEMATIC

CBS-COLUMBIA MODELS 22CX1, 2, 3, 4, 22TX1, 2 (Ch. 1601, 2)

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No	USE	REPLACEMENT DATA: CBS-Columbia PART No	STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amplifier	5BC5	5BC5	TBD	
V2	Mixer-Osc.	5U8	5U8	8AS	
V3	1st. Video IF Amp.	3CB6	3CB6	7CM	
V4	2nd. Video IF Amp.	3CB6	3CB6	7CM	
V5	3rd. Video IF Amp., Sound IF Amp.	3CB6	3CB6	7CM	
V6	Video Output	12BY7	12BY7	9BF	
V7	Audio Detector	12AN6	12AN6	7DF	
V8	Audio Output	12LG7	12LG7	7H	
V9	Sync Separator-Sync Amplifier	6SN7GTB	6SN7GTB	8BD	
V10	Vert. Mult.-Vert. Output	12BH7A	12BH7A	8A	
V11	Horiz. AFC-Horiz. Osc.	6SN7GT	6SN7GT	8BD	
V12	Horiz. Output	12CU6	12CU6	6AM	
V13	Damper	12AX6GT	12AX6GT	6CG	
V14	HV Rectifier	1X2B	1X2B	9T	

CATHODE-RAY TUBE

ITEM No	REPLACEMENT DATA: CBS-Columbia PART No	CBS PART No	GENERAL ELECTRIC PART No	SYLVANIA PART No	WESTINGHOUSE PART No	RETMA BASE TYPE	NOTES
V15	21TP4 21TP4A ①	21TP4 21TP4A ①	- 21TP4A ①	21TP4 21TP4A ①	21TP4 21TP4A ①	12L 12L	① Aluminized ② Silver screen

ELECTROLYTIC CAPACITORS

ITEM No	RATING: CAP	VOLT	REPLACEMENT DATA: CBS-Columbia PART No	MALLORY PART No	PYRAMID PART No	SANGAMO PART No	NOTES
C1	140	200	21000901	WB-437	TM-150-350	S-150	
C2A	±140	300	21001801	FP230-R		T-525	
B	±10	300		WB-437		S-341	
C	±100	25					
C3A	±100	350	21000991			C-152	
B	±200	150				MT-4710	
C	±5	475					
C4	10	150	21001011	TC42	TD-10-150	FM-1512	
C5	10	300	21001021	TC62	TD-11-350	FM-3512	

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No	RATING: CAP	VOLT	REPLACEMENT DATA: CBS-Columbia PART No	CENTRALAB PART No	ERIE PART No	MALLORY PART No	NOTES
C6	470	1000		DD50-471	3EY-471	DC30347	
C7	470	2000		DD30-471	3EV-471	DC30347	
C8	.5-4.5						
C9	9.1						
C10	800			DD-801	831-801	DC-531	
C11	.5-3.5						
C12	47			DD-470	831-470	UC-5447	
C13	1000						
C14	1000						
C15	47			MFT-50			
C16	.5-3.5						
C17	1-4			839-4	31B-01-10	CT931	
C18	7.5						
C19	10						
C20	800			DD-801	831-801	DC-531	
C21	800			DD-801	831-801	DC-531	
C22	1000						
C23	330			DD-331	831-331	UC-5332	
C24	800			DD-801	831-801	DC-531	
C25	1000						
C26	1000						
C27	2000	1000	23046850	DD-502	1R5KV-472		
C28	1500	1000	23046440	DD-153	1R5KV-152	DC30215	
C29	390		23003190	D6-391	GP2K-391	UC-5339	
C30	1500	1000	23046440	DD-159	1R5KV-152	DC30215	
C31	1500	1000	23046440	DD-153	1R5KV-152	DC30215	
C32	1500	1000	23046440	DD-153	1R5KV-152	DC30215	
C33	470		23003200	D6-471	GP2K-471	UC-5347	
C34	5000	1000	23046850	DD-502	1R5KV-472		
C35	470		23002200	D6-471	GP2K-471	UC-5347	
C36	5000	1000	23046850	DD-502	1R5KV-472		
C37	1500	1000	23046440	DD-153	1R5KV-152	DC30215	
C38	100		23001530	D6-101	GP1K-101	UC-531	Note 1
C39	5000	1000	23046850	DD-502	1R5KV-472		
C40	.27	200	22012330				
C41	1500	1000	23046440	DD-153	1R5KV-152	DC30215	
C42	.05	200	22012340	DF-503		P7415	
C43	5000	1000	23046850	DD-502	1R5KV-472		
C44	2000		23000591	D6-202	GP2-333-502	UC-522	
C45	100		23001520	D6-101	GP1K-101	UC-531	
C46	.047	400	23012740	DF-503		PT4147	
C47	370		23001570	D6-371	GP2K-371	UC-5327	
C48	10000		23046030	DD-103	81L-01	DC-511	
C49	10000		23046030	DD-103	81L-01	DC-511	
C50	5000	1000	23046850	DD-502	1R5KV-472		
C51	1000		23001740	D6-102	GP2L-102	UC-531	
C52	.0047	400	23001630	D6-472	GP2-333-472	PT6347	
C53	.01	400	23001650	D6-103	GP2-333-103	PT4113	
C54	.022	400	23011700	DF-303	817-03	PT4123	
C55	470		23002200	D6-471	GP2K-471	UC-5347	
C56	.022	400	22011700	DF-303	817-03	PT4123	
C57	.47	200	22013340			PT4047	
C58	2000		23006591	D6-202	GP2-333-502	UC-522	
C59	5000		23006601	D6-502	GP2-333-502	UC-525	
C60	5000		23006601	D6-502	GP2-333-502	UC-525	
C61	1500	300	23002280	D6-152	GP2L-152	UC-5315	
C62	.1	200	23012390	DF-104		PT4013	

CAPACITORS (cont)

ITEM No	RATING: CAP	VOLT	REPLACEMENT DATA: CBS-Columbia PART No	CENTRALAB PART No	ERIE PART No	MALLORY PART No	NOTES
C63	.015	400	22008680				
C64	.047	400	22008240				
C65	.1	400	22008280	DF-503		PT401	
C66	680		23001730	D6-681	GP2K-681	UC-5368	
C67	1000	1000	23046070	DD-102	1R5KV-102	DC3021	
C68	1500	1000	23046440	DD-153	1R5KV-152	DC30215	
C69	.022	600	23012200	DF-303	817-03	PT4123	
C70	.047	600	23012240	DF-503		PT6147	
C71	68	500	23003790	D6-680	801-680		
C72	68	500	23003790	D6-680	801-680		
C73	.047	400	23008204	DF-503		PT4147	
C74	.022	400	23008200	DF-303	817-03	PT4123	
C75	.01	300	23004180	D6-103	GP2-333-103	PT411	
C76	.22	300	23007820			PT4023	
C77	180	500	23003390	D6-181	811-181	MC2237	
C78	.01	200	23004180				
C79	1200	500	23001790				
C80	1000		23003240	D6-102	GP2L-102	UC-531	
C81	.047	200	23011340	DF-503		PT4147	
C82	.022	600	23011700	DF-303	817-03	PT4123	
C83	.047	400	23008240				
C84	.1	200	23011280	DF-104		PT401	
C85	2000			DD30-470		DC30447	Note 2
C86	5000	1400	23067020		1R5KV-472		
C87	1500	1000	23046440	DD-152	1R5KV-152	DC30215	
C88	1500	1000	23046440	DD-152	1R5KV-152	DC30215	
C89	1500	1000	23046440	DD-152	1R5KV-152	DC30215	
C90	1500	1000	23046440	DD-153	1R5KV-152	DC30215	
C91	1500	1000	23046440	DD-153	1R5KV-152	DC30215	
C92	1500	1000	23046440	DD-152	1R5KV-152	DC30215	
C93	.01	800	23017660	DD-103	GP3-333-103	PT611	
C94	1500	1400	23067020	DD30-152	1R5KV-152	DC30215	

Note 1. Not used in some versions.
Note 2. Some versions use 56MMF in this application.

CONTROLS

ITEM No.	RATING: RESIST-ANCE	WATTS	REPLACEMENT DATA: CBS-Columbia PART No	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	750Ω	½	38001371					Contrast (Panel)
B	250Ω	½						Volume (Rear)
C	Switch					KB-1		Attach to R1B.
R2A	100KΩ	½	38001361	QJ-783 ▲	RTV-534	F1-32	UP15L ‡	Horizontal Hold (Panel)
B	300KΩ	½				R2-33	UR254L ‡	Vertical Hold (Rear)
R3A	5Meg	½	38001291	QH-141	A47-5Meg-A	AB-87	TA56L	Height
B	Shaft		Not Req.	Not Req.	R2-2	AK-4	Not Req.	Attach to R3A.
R4A	250KΩ	½	38001301	QH-130	A47-250K-A	AB-50	TA254L	Brightness
B	Shaft		Not Req.	Not Req.	R2-2	AK-4	Not Req.	Attach to R4A.
R5	4000Ω	2	38001281		39-3000-700			Vertical Linearity (Stop at 1000Ω) (Wire Wound)
R6	600Ω	3	38001311		39-600			AM Rejection (Wire Wound)

‡ Universal replacement (Mallory exact duplicate Part No. UE15L).

▲ CONCENTRIKIT EQUIVALENT, K-2 KIT, BASE ELEMENTS AND SHAFTS, B1L-126, P1-102 (Panel) B1L-132, R2-117 (Rear)

RESISTORS

ITEM No.	RATING: OHMS	WATT	REPLACEMENT DATA: CBS-Columbia PART No.	IRC PART No.	NOTES
R7	470KΩ	½		BTS-470K	
R8	470KΩ	½		BTS-470K	
R9	47KΩ	½		BTS-47K	
R10	15KΩ	½			
R11	3300Ω	½		BTS-3300	
R13	12KΩ	½			
R13	220Ω	½		BTS-220	
R14	100KΩ	½			
R15	100KΩ	½			
R16	10KΩ	½			
R17	15KΩ	½			
R18	10KΩ	½			
R19	330Ω	1			
R20	27KΩ	½	30272230		
R21	1000Ω	½	30102350	BTS-1000	
R22	1Meg	½	30105330	BTS-1Meg	
R23	330Ω	½	30331330	BTS-330	
R24	100Ω	½	30331320	BTS-100	
R25	47Ω	½	30470230	BTS-47	
R26	56KΩ	½	30563230		
R27	33Ω	½	30331350	BTS-330	
R28	47Ω	½	30470230	BTS-47	
R29	1000Ω	½	30102350	BTS-1000	
R30	1000Ω	½	30102330	BTS-1000	
R31	56KΩ	½	30563230		
R32	1000Ω	½	30102350	BTS-1000	
R33	4700Ω	½	30472330		
R34	180Ω	½		BTS-180	Note 1
R35	1000Ω	½	30102330	BTS-1000	
R36	1500Ω	½	30152330	BTS-1500	
R37	270KΩ	½	30272330		
R38	100KΩ	½	30104330		
R39	1Meg	½	30105330		
R40	1Meg	½	30105350		
R41	27KΩ	1	30272240		
R42	10KΩ	2	30102250		
R43	10KΩ	2	30102250		
R44	100Ω	½	30101230	BTS-100	
R45	12KΩ	½	30123230		
R46	22KΩ	½	30223230		
R47	150KΩ	½	30154230		
R48	1000Ω	½	30102330	BTS-1000	

ITEM No.	RATING: OHMS	WATT	REPLACEMENT DATA: CBS-Columbia PART No.	IRC PART No.	NOTES
R49	390Ω	1	30392240	BTA-3000	
R50	1000Ω	½	30102330	BTS-1000	
R51	33KΩ	½	30223330	BTS-22K	
R52	1Meg	½	30105230	BTS-1Meg	
R53	1Meg	½	30105330	BTS-1Meg	
R54	5.6Meg	½	30565230	BTS-5.6Meg	
R55	15KΩ	2	30152250	BTS-15K	
R56	330KΩ	½	30334230		
R57	2.2Meg	½	30225230		
R58	82K	½	30822230		
R59	150KΩ	½	30154230		
R60	330KΩ	½	30334230		
R61	10KΩ	½	30102230		
R62	330KΩ	½	30332230		
R63	10KΩ	½	30102230		
R64	330KΩ	½	30332230		
R65	22KΩ	½	30223230		
R66	820KΩ	½	30823230		
R67	820KΩ	½	30823230		
R68	150KΩ	½	30154250		
R69	10MΩ	½	30106250		
R70	100KΩ	½	30104230		
R71	2.5Meg	½	30225230		
R72	330KΩ	½	30334230		
R73	100KΩ	½	30104230		
R74	22KΩ	½	30223230		
R75	470Ω	½			
R76	470Ω	½			
R77	680Ω	½	30681230	BTS-680	
R78	330KΩ	½	34334230		
R79	820KΩ	½	34824230		
R80	22KΩ	½	34223230		
R81	68KΩ	½	34683230		
R82	82KΩ	½	34823230		
R83	330KΩ	½	34334230		
R84	820KΩ	½	34823230		
R85	150KΩ	½	3415 4230		
R86	150KΩ	½	34154230		
R87	82KΩ	½	34823230		
R88	47K	½	34473240		
R89	270KΩ	½	30374230		
R90	270KΩ	½	30274230		

RESISTORS (cont)

ITEM No	RATING: OHMS	WATT	REPLACEMENT DATA: CBS-Columbia PART No	IRC PART No.	NOTES
R91	210KΩ	½	30274230		
R92	1Meg	½	30105230		
R93	82000Ω	½	31000471	PW10-82OO	
R94	5000Ω	2	30983250	BTB-5000	
R95	470Ω	½			

ITEM No	RATING: OHMS	WATT	REPLACEMENT DATA: CBS-Columbia PART No	IRC PART No.	NOTES
R96	3.9Ω	1	31000010	BWI-3.9	
R97	46Ω	25	31000481		
R98	7.5Ω	5	31000472	PW10-7.5	
R99	2300Ω	2	30284472	BTB-2300	

Note 1. Some versions use a 120Ω ½W resistor in this application.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	REPLACEMENT DATA: CBS-Columbia PART No.	Halldorson PART No.	Merit PART No.	RCA TYPE No.	Rem PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No
T1	Horiz. Output Trans.	12001051							
T2	Vert. Output Trans.	18000581	21900 ② ①	A-2824 ①		V313 ①	A-8123 ①	26853 ①	A-102X ②
T3A	Yoke-Horiz. (23MP)	18900361 ⑤	DF805 ④⑤	MDF-78 ②	322D1 ④ ⑤	T70F35 ④	DY-15A ④ ⑤	Y-10 ④ ⑤	Y-19-1 ④ ⑤
B	Vert. (40MP)								

① Drill new mounting hole(s).
② Connect as auto transformer.
③ Use 15 to 1 turns ratio.
④ Connect horizontal damping network across terminals #3 and #7, use original network if necessary.
⑤ Use original rear cover and centering device.
⑥ Includes capacitor C85, resistors R75, R76, R95

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE: PRI	SEC	REPLACEMENT DATA: CBS-Columbia PART No	Halldorson PART No	Merit PART No	Stancor PART No	Thordarson PART No	Triad PART No	NOTES
T4	2.15KΩ	3.5Ω	Part of spkr.	21005	A-2828	A-3876	24650	S-1X	

SPEAKER

ITEM No.	RATINGS: SIZE	FIELD	V. C. IMP	REPLACEMENT DATA: CBS-Columbia PART No.	OUAM PART No.	NOTES
SP1	5"	53Ω	3.5Ω	73000521 73000522 ① 73000551 ⚓	5E508	① Used in console chassis 1801. ② Used in console chassis 1802.

COILS (RF-IF)

ITEM No.	USE	DC RES: PRI.	SEC.	REPLACEMENT DATA: CBS-Columbia PART No	MEISSNER PART No	MERIT PART No	MILLER PART No	NOTES
L1	Ant. Coils	0Ω	0Ω					
L2	RF, Mixer Grid, Osc. Coils	0Ω						
L3	Fil. Choke	0Ω						
L4	Conv. Plate	.1Ω	0Ω					
L5	1st. Video IF	0Ω	.1Ω	12001011	17-5003 *	TV-127 *	6332 *	
L6	Fil. Choke	0Ω		18000651	19-1001		6604	1.5 Microhenries
L7	2nd. Video IF	.1Ω	.1Ω	12001121	17-5002 *	TV-127 *	6232 *	
L8	Fil. Choke	0Ω		18000651	19-1001		6604	1.5 Microhenries
L9	3rd. Video IF	.1Ω	.1Ω	12001281	17-5004 #			
L10 A	4th. Video IF	.1Ω	.1Ω					
B	2nd. Sound IF	1.1Ω		12001041				
L11	1st. Sound IF	.7Ω		15000871				
L12	Series Peaking Coil	10Ω		16000361	19-3180 ▲	TV-184 ▲	6180 ▲	180 Microhenries, wound on 33KΩ resistor
L13	Shunt Peaking Coil	17Ω		16000045	19-3500		6174	500 Microhenries
L14	Series Peaking Coil	8.3Ω		15000701	19-1005		6623	10 Microhenries, IRC part #CL-1
L15	Series Peaking Coil	12Ω		16001863	19-3360 ▲	TV-188 ▲	6181 ▲	360 Microhenries, wound on 39KΩ resistor
L16	Shunt Peaking Coil	12Ω		16000045	19-3500		6174	530 Microhenries
L17	RF Choke	8.5Ω		16000042	19-3180	TV-184	6180	180 Microhenries
L18	Quadrature Coil	4.4Ω	57Ω	15000721	17-1021 ▲	TV-13 ▲	1481	
L19	Horiz. Osc.	23Ω		15000681	20-1402 †	TV-182 †	6182 †	Waveform winding-400

† Detune trap.
▲ Parallel with 33KΩ resistor.
▲ Parallel with 39KΩ resistor.
Cut out chassis hole and drill mounting holes.
▲ Use one winding only.
† Reverse coil mounting in can.
# Add 180MMF capacitor externally.

SELENIUM RECTIFIER

ITEM No.	RATING: CURRENT	REPLACEMENT DATA: CBS-Columbia PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	NOTES
M1	.190ADC	63000681	1236A	MR-300	6S300	644	300	
M2	.190ADC	63000061	1236A	MR-300	6S300	644	300	

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA: CBS-Columbia PART No. FUSE	HOLDER	LITTELFUSE PART No. FUSE	HOLDER	BUSS PART No. FUSE	HOLDER
M3	3AG P/T (3/B LA)	LA 115V	43000190		31500I (3AG P/T (3/B LA)		MDV1	

PROPERTY OF L. F. BLANKENSHIP 3924 MEADE ST. DENVER, COLORADO

CRIPTIONS

nt)

LORY T No.	NOTES
01	
5368	
021	
0215	
.22	
47	
147	
22	
J	
022	
1237	
521	
147	
122	
01	
0447	Note 2
0215	
0215	
0215	
0215	
0215	
0215	
11	
0215	

AB	MALLORY PART No.	INSTALLATION NOTES
		Contrast (Panel)
		Volume (Rear)
		Attach to R1B.
	UF15L } †	Horizontal Hold (Panel)
	UR254L }	Vertical Hold (Rear)
	TA56L	Height
	Not Req.	Attach to R3A.
	TA254L	Brightness
	Not Req.	Attach to R4A.
		Vertical Linearity (Stop at 1000Ω), (Wire Wound)
		AM Rejection (Wire Wound)

FTS, B11-128, P1-102 (Panel)
B11-129, R2-117 (Rear)

RATING		REPLACEMENT DATA		NOTES
OHMS	WATT	CBS-Columbia PART No.	IRC PART No.	
00Ω	1	30392240	BTA-3900	
0Ω	½	30102230	BTS-1000	
KΩ	½	30223330	BTS-22K	
eg	½	30105230	BTS-1Meg	
eg	½	30105230	BTS-1Meg	
5Meg	½	30565230	BTS-5. 6Meg	
Ω	2	30153250	BTB-15K	
KΩ	½	30334230		
2Meg	½	30225230		
K	½	30823230		
KΩ	½	30154230		
KΩ	½	30334230		
Ω	½	30103230		
00Ω	½	30332230		
Ω	½	30103230		
00Ω	½	30332230		
KΩ	½	30223230		
00Ω	½	30822230		
00Ω	½	30822230		
KΩ	½	30154230		
Meg	½	30106230		
KΩ	½	30104230		
2Meg	½	30225230		
KΩ	½	30384230		
KΩ	½	30104230		
KΩ	½	30223230		
0Ω	½			
0Ω	½			
0Ω	½	30681230	BTS-680	
KΩ	½	34334230		
KΩ	½	34824230		
KΩ	½	34223230		
KΩ	½	34683230		
KΩ	½	34823230		
KΩ	½	34334230		
00Ω	½	34822230		
KΩ	½	34154230		
KΩ	½	34154230		
00Ω	½	34822230		
K	1	34473240		
KΩ	½	30274230		
KΩ	½	30274230		

RESISTORS (cont)

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	CBS-Columbia PART No.	IRC PART No.	
R91	270KΩ	½	30274230		
R92	1Meg	½	30105230		
R93	8200Ω	5	31000471	PW10-8200	
R94	5600Ω	2	30562250	BTB-5600	
R95	470Ω	½			

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	CBS-Columbia PART No.	IRC PART No.	
R96	3. 9Ω	½	31000010	BW½-3. 9	
R97	46Ω	25	31000481		
R98	7. 5Ω	6	31000472	PW10-7. 5	
R99	220KΩ	2	30224472	BTB-220K	

Note 1. Some versions use a 120Ω ½W resistor in this application.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	REPLACEMENT DATA							
		CBS-Columbia PART No.	Halldorson PART No.	Merit PART No.	RCA TYPE No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	Horiz. Output Trans.	12001051							
T2	Vert. Output Trans.	10000611	Z1900 ② ③	A-2824 ①		V313 ①	A-8123 ①	26852 ①	A-109X ②
T3A	Yoke-Horiz. (23MH)	16001351 ⑥	DF605 ④ ⑤	MDF-75 ④ ⑤	222D1 ④ ⑤	Y70F25 ④ ⑤	DY-15A ④ ⑤	Y-10 ④ ⑤	Y-19-1 ④ ⑤
B	Vert. (40MH)								

① Drill new mounting hole(s).
② Connect as auto transformer.
③ Use 15 to 1 turns ratio.
④ Connect horizontal damping network across terminals #3 and #7, use original network if necessary.
⑤ Use original rear cover and centering device.
⑥ Includes capacitor C85, resistors R75, R76, R95

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	CBS-Columbia PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T4	2.15KΩ	3. 5Ω	Part of spkr.	Z1005	A-2928	A-3876	24S50	S-1X	

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA		NOTES
	SIZE	FIELD	V. C. IMP.	CBS-Columbia PART No.	QUAM PART No.	
SP1	5"	52Ω	3. 5Ω	73000521 73000522 ① 76000551 ②	5E50S	① Used in console chassis 1601. ② Used in console chassis 1602.

COILS (RF-IF)

ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	CBS-Columbia PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1	Ant. Coils	0Ω	0Ω					
L2	RF, Mixer Grid, Osc. Coils	0Ω						
L3	Fil. Choke	0Ω						
L4	Conv. Plate	.1Ω	0Ω					
L5	1st. Video IF	0Ω	.1Ω	12001011	17-5002 *	TV-127 *	6232 *	
L6	Fil. Choke	0Ω		15000651	19-1001		4604	1.5 Microhenries
L7	2nd. Video IF	.1Ω	.1Ω	12001121	17-5002 *	TV-127 *	6232 *	
L8	Fil. Choke	0Ω		15000651	19-1001		4604	1.5 Microhenries
L9	3rd. Video IF	.1Ω	.1Ω	12001031	17-5014 #			
L10 A	4th. Video IF	.1Ω	.1Ω					
B	2nd. Sound IF	1.1Ω		12001041				
L11	1st. Sound IF	.7Ω		15000671				
L12	Series Peaking Coil	10Ω		16000361	19-3180 ■	TV-184 ■	6180 ■	180 Microhenries, wound on 33KΩ resistor
L13	Shunt Peaking Coil	17Ω		16000045	19-3500		6174	500 Microhenries
L14	Series Peaking Coil	8.2Ω		15000701	19-1005		4612	10 Microhenries, IRC part #CL-1
L15	Series Peaking Coil	12Ω		16001362	19-3250 ▲	TV-185 ▲	6181 ▲	246 Microhenries, wound on 39KΩ resistor
L16	Shunt Peaking Coil	12Ω		16000045	19-3500		6174	530 Microhenries
L17	RF Choke	9.5Ω		16000042	19-3180	TV-184	6180	180 Microhenries
L18	Quadrature Coil	4.4Ω		15000721	17-1031 ♦	TV-113 ▲	1481	
L19	Horiz. Osc.	23Ω	57Ω	15000681	20-1402 †	TV-162 †	6183 †	Waveform winding-40Ω

* Detune trap.
■ Parallel with 33KΩ resistor.
▲ Parallel with 39KΩ resistor.
♦ Cut out chassis hole and drill mounting holes.
▲ Use one winding only.
† Reverse coil mounting in can.
# Add 180MMF capacitor externally.

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	CBS-Columbia PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M1	.190ADC	62000061	1236A	MR-300	6S300	6Q4	300	
M2	.190ADC	62000061	1236A	MR-300	6S300	6Q4	300	

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			CBS-Columbia PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M3	3AG P/T S/B	1A 125V	43000150		315001 (3AG P/T S/B 1A)		MDV1	

PARTS LIST AND DESCRIPTIONS (Continued)

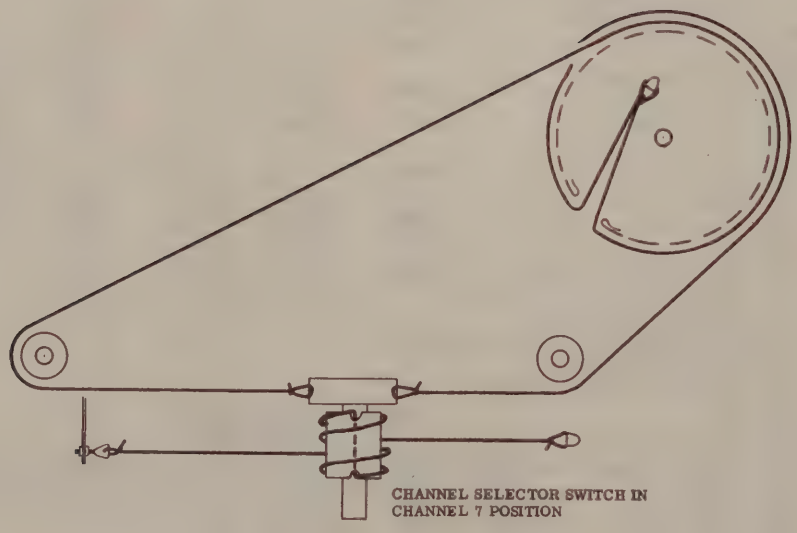
CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA		NOTES
		CBS-Columbia PART No.	SYLVANIA PART No.	
M4	1N60*	63000091	1N60 or 1N132	Video Det.

* Some versions may use crystal diode type 1N64 in this application.

MISCELLANEOUS

ITEM No.	PART NAME	CBS-Columbia PART No.	NOTES
M5	Tuner	69000631	VHF - Not used in all versions
	Tuner	69000641	VHF - Used in some versions
M6	Trap		VHF Ant. Input Filter, used with tuner part #69000631.
M7	Switch	40000321	Local-Distance (Rotary - wafer type, single pole- 3 position)
M8	Centering Device		Part of deflection yoke - rear cover (T3)
M9	Ion Trap	19000081	
B3	Trimmer Cap.	2500011	Horiz. Drive (25-100MMF)
	Knob	76003261	Channel Selector
	Knob	76003122	On-off-volume & vertical hold - Models 22TX1, 22TX2 (Cordovan), 22CX3, 22CX4
	Knob	76003121	On-off-volume & vertical hold - Models 22TX2 (gray & sand), 22CX1, 22CX2
	Knob	76003132	Contrast & horizontal hold - Models 22TX1, 22TX2 (cordovan), 22CX3, 22CX4
	Knob	76003131	Contrast & horizontal hold - Models 22TX2 (gray & sand), 22CX1, 22CX2
	Knob	76003331	Local-distance
	Knob	76003441	Fine tuning
	Insert	76003451	Fine tuning knob, red
	Insert	76003453	Fine tuning knob , gray - Models 22TX2 (cordovan), 22TX2 (sand)
	Insert	76003452	Fine tuning knob, charcoal - Models 22TX2 (gray), 22CX3, 22CX4
	Safety Glass	77000357	Models 22TX1, 22TX2, 22CX1, 22CX2
	Safety Glass	77000432	Models 22CX3, 22CX4
	Mask	71001411	All models



DRIVE CORD STRINGING

TROUBLE SHOOTING AIDS (cont)

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V11, V12, V13 and V14. Check waveform W12.

If Satisfactory	If Unsatisfactory
Check T1, T3A, C82, C83, C84, C3C, R93 and other associated components.	Check L19, C73, C77, C78, C80, R80, R88, R87, R2A and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V12 and V13. Check M1 and M2. Check R93, R98, C1, C80 and other associated components.

BLOOMING

Check by substitution V12, V13 and V14. Check M1 and M2. Check R93, R98, C1, C80 and other associated components.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video".

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or no Sound".

RASTER, NO SOUND, NO PICTURE

Check by substitution V1, V2, V3, V4, V5, V6 and V8. Check video IF components for failure or change of value.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set".

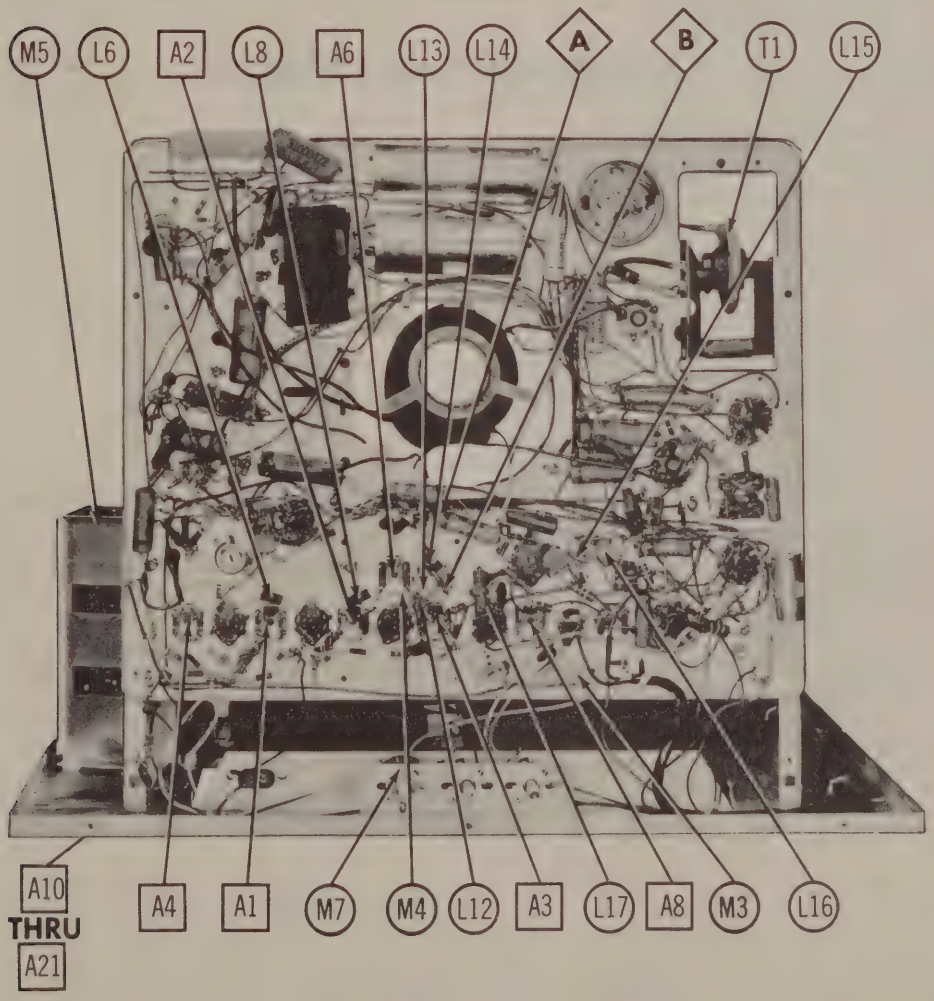
KEYSTONE EFFECT

Check T3 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



CHASSIS BOTTOM VIEW-TRANS., INDUCTOR & ALIGN. IDENTIFICATION

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

For touch-up adjustment of VHF tuner oscillator adjustments, it is necessary to remove the chassis from the cabinet. (See disassembly instructions).

PICTURE TUBE SAFETY GLASS CLEANING

For picture tube safety glass cleaning, it is necessary to remove chassis. (See disassembly instructions).

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION

(See cabinet-rear view on page 11).

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

For adjustment of the horizontal oscillator, it is necessary to remove the rear cover and supply power to set. Adjustment is located on bottom of chassis. Set the horizontal hold control at the center of its range and adjust the horizontal frequency slug of L19 until picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, it is necessary to remove the rear cover and supply power to set. Adjust the AM Rejection Control (R6) for maximum volume and minimum buzz.

FUSES

One fuse is used for LV power supply protection. (For location see tube placement chart).

CENTERING

Centering is accomplished mechanically by adjusting two magnetic rings around the neck of the picture tube, located flush against the deflection yoke. Rotate the two rings around the neck of the tube until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

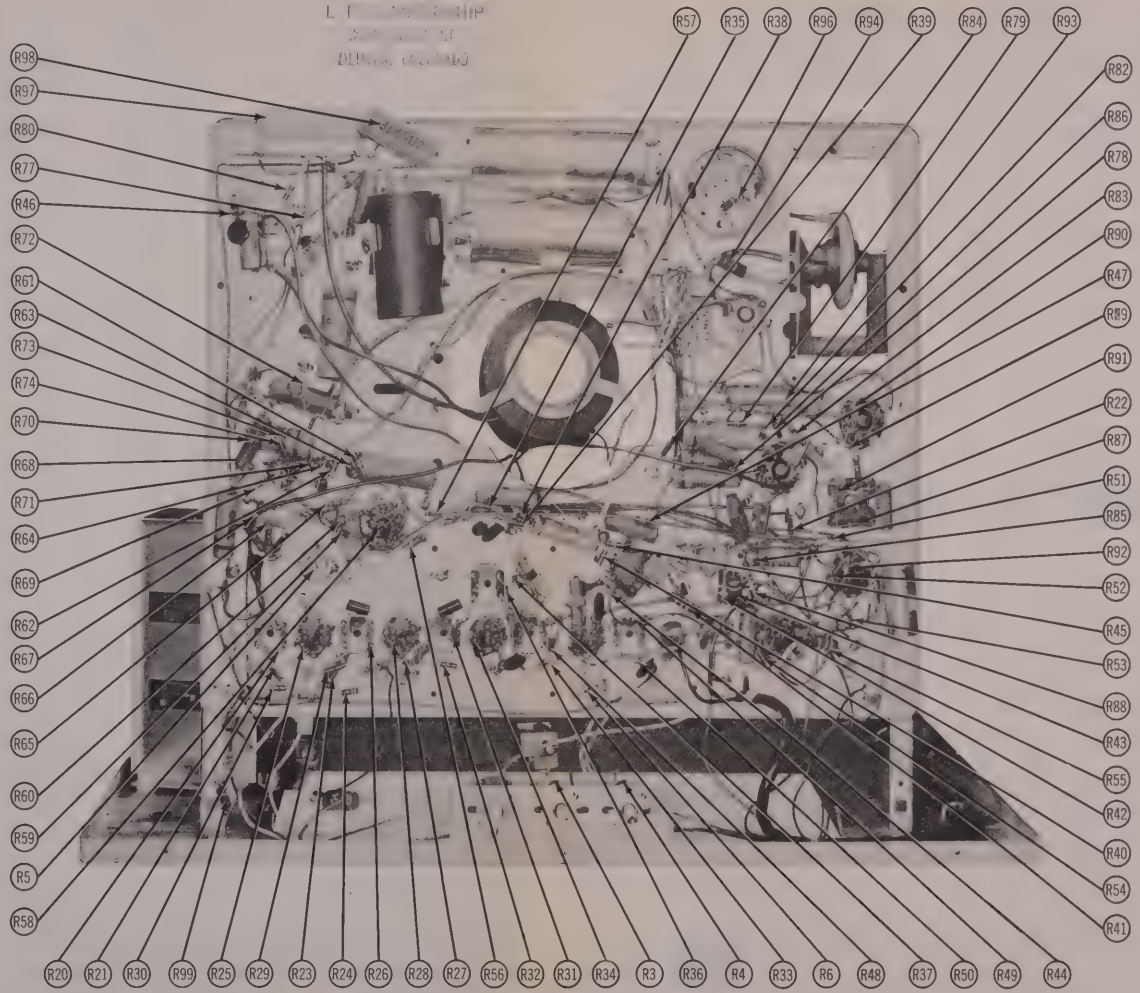
CHASSIS REMOVAL - TABLE MODELS

1. Remove the local-distance knob and 10 metal screws. Remove rear cover.
2. Remove 3 metal screws. Remove bottom access cover.
3. Disconnect speaker plug.
4. Remove 6 metal screws (three from each side), spread cabinet at the bottom and lift off.
5. Remove 2 speaker nuts. Remove speaker.

CHASSIS REMOVAL - CONSOLE MODELS

1. Remove 6 push-on type control knobs from front panel of cabinet.
2. Remove local-distance knob and remove 10 screws. Remove rear cover.
3. Disconnect speaker plug.
4. Remove 4 screws holding base pan to cabinet shelf.
5. Remove interlock bracket mounted on the left wall of the cabinet and the chassis mounting bracket on the right wall of the cabinet.
6. Slide chassis as far out of the cabinet as stops on mounting permits, then lift the back edge of bottom pan up above one inch and slide chassis all the way out.
7. Remove 2 speaker nuts. Remove speaker.

NOTE: If it is necessary to remove the chassis for servicing, it is also necessary to remove the speaker . The speaker is the electro-magnetic type and must be connected for proper operation.



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

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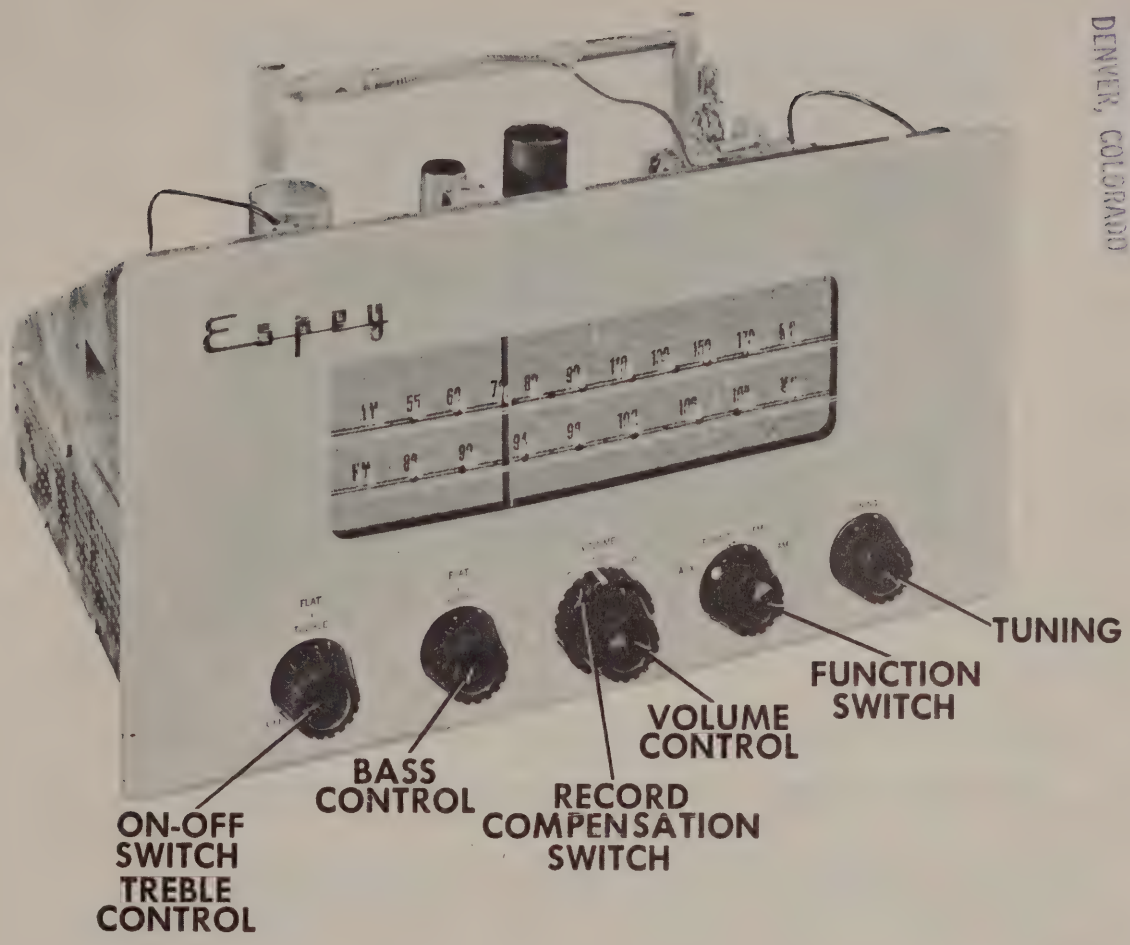

ESPEY
MODEL 401

TRADE NAME	Espey Model 401
MANUFACTURER	Espey Mfg. Co., 528 E. 72nd. St., New York 21, N.Y.
TYPE SET	AC Operated AM-FM Superheterodyne Tuner For Custom Installation
TUBES	Eleven
TUNING RANGE-BROADCAST 535KC-1720KC	FREQ. MOD. 88MC-108MC

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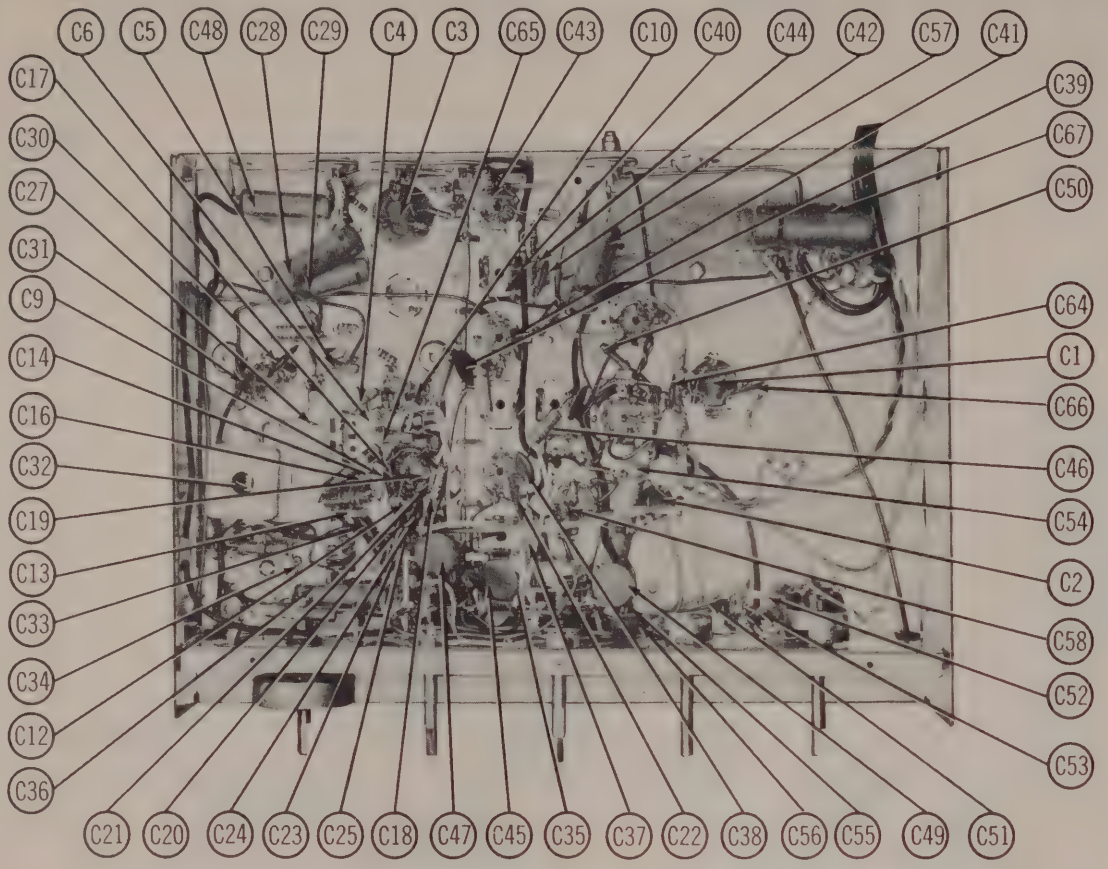
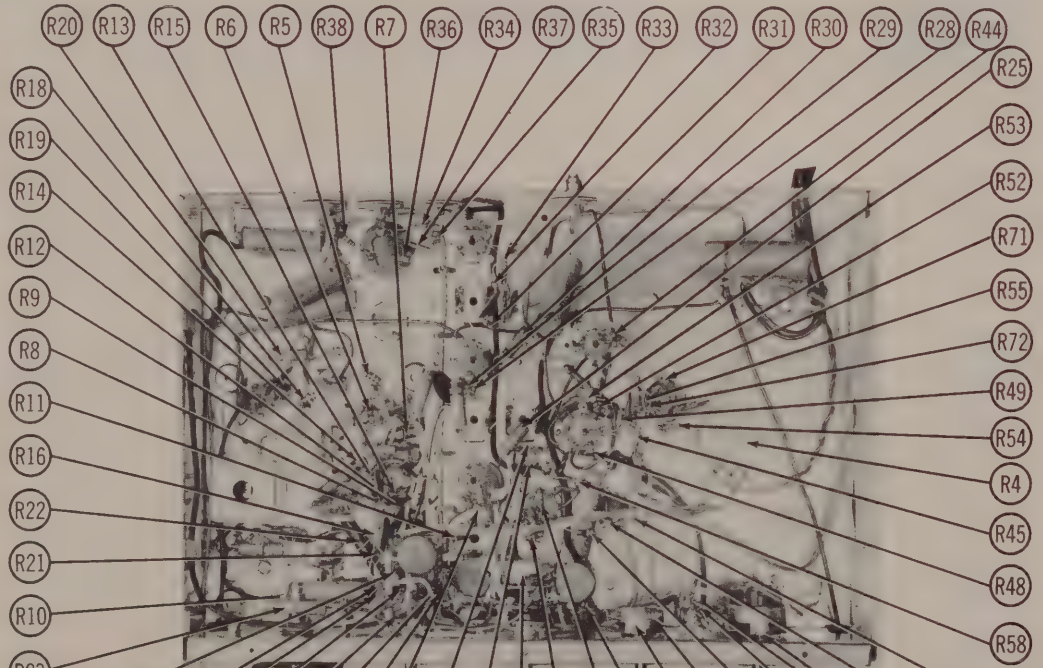


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



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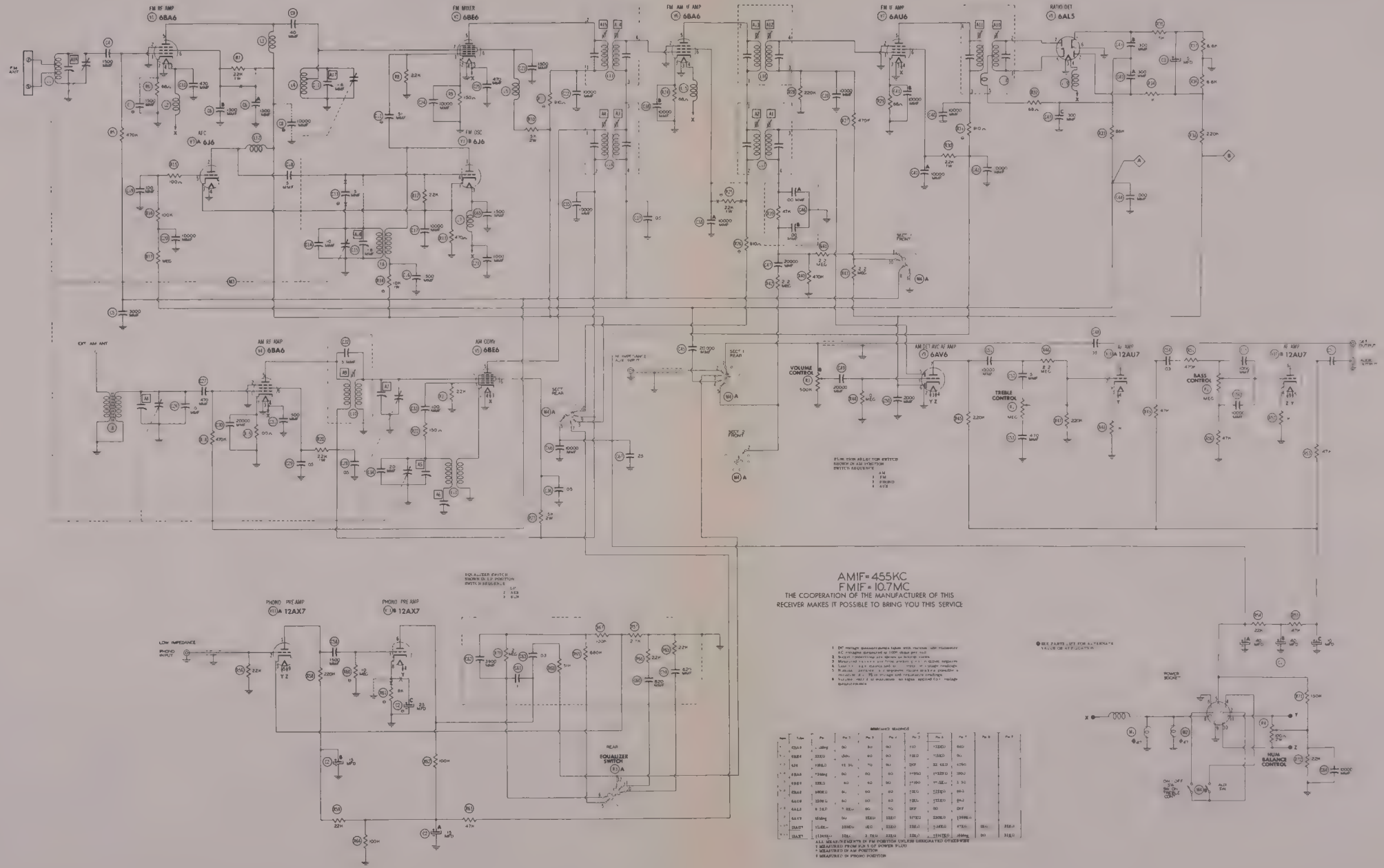

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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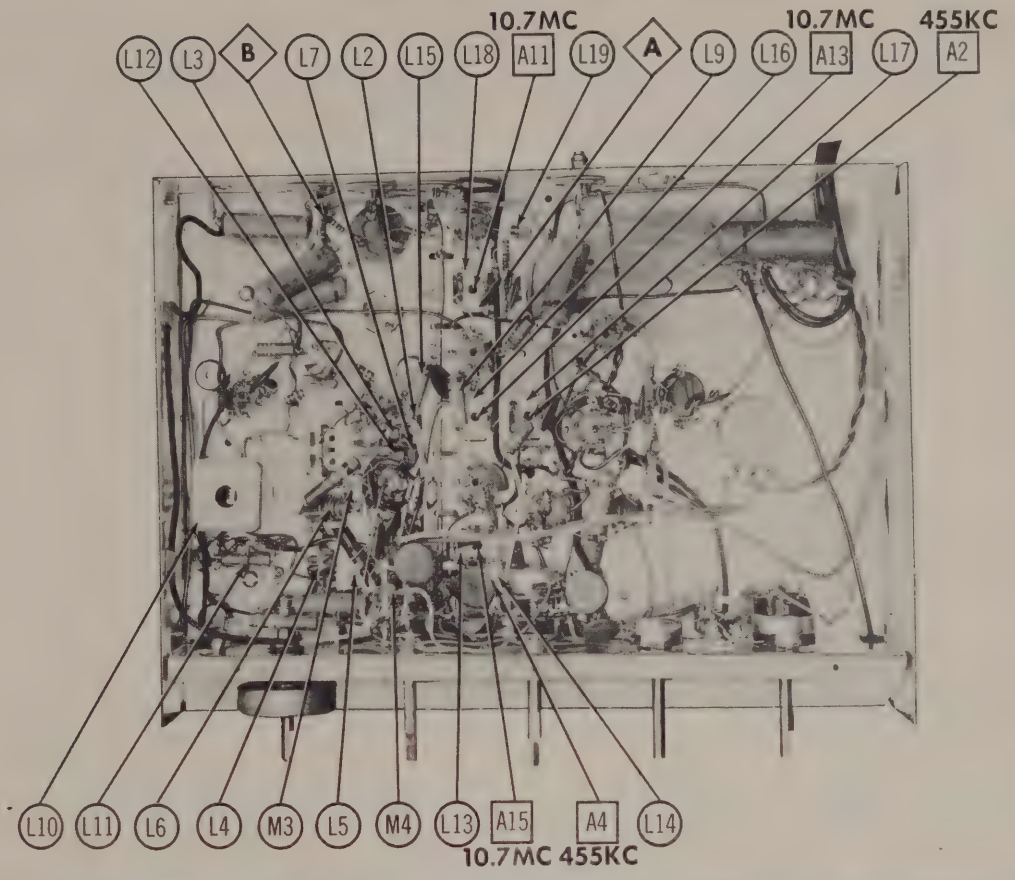
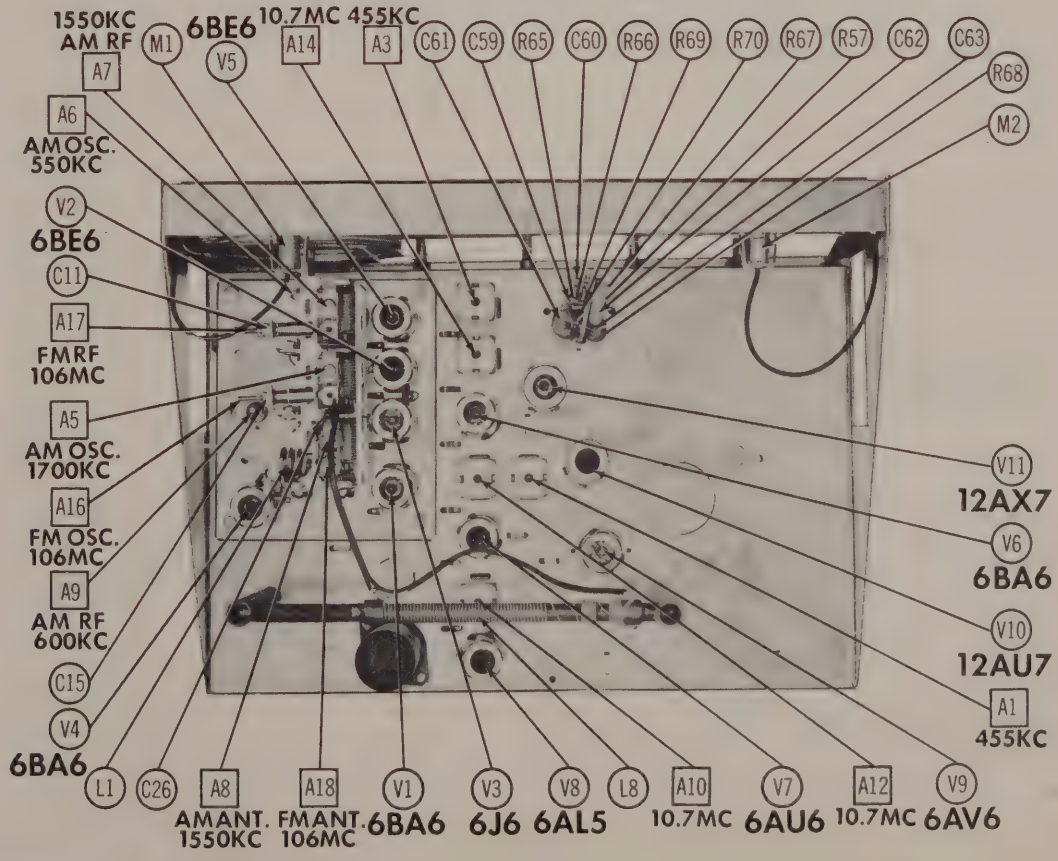


CHASSIS BOTTOM VIEW- INDUCTOR AND ALIGNMENT IDENTIFICATION



CHASSIS TOP VIEW

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Allow 15 minute warm-up period for receiver and test equipment.
Set treble and bass controls to maximum clockwise position.
With tuning gang fully closed set pointer to index mark (small gold mark) to left of "55" on dial.
Amplifier and speaker should be connected for normal use during alignment procedure.
Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading.
Use an insulated alignment screwdriver for adjusting.

AM ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1.	.01MFD	High side to pin 1 (grid) of 6BA6 (V6). Low side to chassis.	455KC (400~Mod)	AM	Tuning gang fully open	Across voice coil	A1, A2	Adjust for maximum deflection.
2.	"	High side to pin 7 (grid) of 6BE6 (V5). Low side to chassis.	"	"	"	"	A3, A4	"
3.	5MMF	High side to AM antenna lug. Low side to chassis.	1700KC	"	1700KC	"	A5	"
4.	"	"	550KC	"	550KC	"	A6	Adjust for maximum deflection. Repeat steps 3 and 4 for proper oscillator tracking.
5.	"	"	1500KC	"	Tune to 1500KC signal	"	A7, A8	Adjust for maximum deflection.
6.	"	"	600KC	"	Tune to 600KC signal	"	A9	Adjust for maximum deflection. Repeat steps 5 and 6 for proper tracking.

FM IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
7	.01MFD	High side to pin 1 (grid) of 6AU6 (V7). Low side to chassis.	10.7MC	FM	Point of non-interference	DC probe to point (A). Common to chassis.	A10	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.
8.	"	"	"	"	"	DC probe to point (B). Common to chassis.	A-11	Adjust for maximum deflection. Repeat steps 7 and 8.
9.	"	High side to pin 1 (grid) of 6BA6 (V6). Low side to chassis.	"	"	"	"	A13, A14	Adjust for maximum deflection. Attenuate generator to maintain -1.5 volts at VTVM.
10.	"	High side to pin 7 (grid) of 6BE6 (V2). Low side to chassis.	"	"	"	"	A15, A16	"

FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60~ modulation and 450KC sweep. Use 120~ sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT SCOPE	ADJUST	REMARKS
7.	.01MFD	High side to pin 7 (grid) of 6BE6 (V2). Low side to chassis.	10.7MC (450KC Swp)	FM	Point of non-interference	Vert. Amp. to point (B). Low side to chassis.	A11, A12, A13, A14, A15	Disconnect stabilizing capacitor (C3). Adjust for curve of maximum amplitude and symmetry similar to Fig. 1.
8.	"	"	"	"	"	Vert. Amp. to point (A). Low side to chassis.	A10	Reconnect stabilizing capacitor (C3). Adjust so that 10.7MC occurs at center of crossover lines, similar to Fig. 2. SLIGHTLY retouch A-11 for maximum amplitude and straightness of crossover lines. Proceed with step 11.

FM RF ALIGNMENT

Attenuate signal generator output to maintain -1.5 volts at VTVM.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
11.	270Ω Carbon Resistor	High side thru 270Ω to FM antenna lug. Low side to chassis.	108MC	FM	108MC	DC probe to point (B). Common to chassis.	A16	Adjust for maximum deflection.
12.	"	"	106MC	"	106MC	"	A17, A18	"
13.	"	"	90MC	"	90MC	"		If necessary, adjust A5 and A1 for maximum deflection by compressing or expanding coil turn. Repeat steps 12 and 13 to obtain proper RF tracking.

HUM BALANCE ADJUSTMENT

Allow tuner to warm-up for at least 10 minutes with record player disconnected and perform the following the following operations.

1. Set function switch to "phono" position.
2. Set volume control fully clockwise.
3. Set record equalizer to "AES" position.
4. Reverse AC line plug and leave position that gives LEAST HUM.
5. Adjust hum balance control (R4A) for MINIMUM background noise and residual hum.

FIG. 1

FIG. 2

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: ESPEY PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	FM RF Amp.	6BA6	6BA6	7BK	
V2	FM Mixer	6BE6	6BE6	7CH	
V3	FM Osc.-AFC	6J6	6J6	7BF	
V4	AM RF Amp.	6BA6	6BA6	7BK	
V5	AM Converter	6BE6	6BE6	7CH	
V6	FM-AM IF Amp.	6BA6	6BA6	7BK	
V7	FM IF Amp.	6AU6	6AU6	7BK	
V8	Ratio Det.	6AL5	6AL5	6BT	
V9	AM Det.-AVC-AF Amp.	6AV6	6AV6	7BT	
V10	AF Amplifier	12AU7	12AU7	9A	
V11	Phono Pre-Amp.	12AX7	12AX7	9A	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: ESPEY PART No.	REPLACEMENT DATA: MALLORY PART No.	REPLACEMENT DATA: PYRAMID PART No.	REPLACEMENT DATA: SANGAMO PART No.	NOTES
C1A	▪40	450		FP376.8	TM-404010-450	T-165	
B	■40	450					
C	▲10	450					
C2A	■15	350		FP345.5	TM-D15-400	D-155	
B	▲15	350					
C	25	25					Note 1
C3	5	250		TC50X	TM-5-250	S-245	

Note 1. C2C not used in some versions.

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: ESPEY PART No.	REPLACEMENT DATA: CENTRALAB PART No.	REPLACEMENT DATA: ERIE PART No.	REPLACEMENT DATA: MALLORY PART No.	NOTES
C4	1500			D6-152	GP2L-152	UC-5215	
C5	3000			D6-302	GP2-333-302	UC-523	
C6A	1500			D6-152	GP2L-152	UC-5215	
B	1500			D6-152	GP2L-152	UC-5215	
C7	1500			D6-152	GP2L-152	UC-5215	Note 2
C8	10000			DD-103	811-01	DC-511	Note 2
C9	40			TCZ-39	NP0L-390		
C10	470			DD-471	811-471	UC-5347	
C11	1- 8			829-7	530-10		
C12	51			TCZ-51	NP0-338-510	ZT-545	Note 3
C13	5			TCZ-4R7	NP0A-050	ZT-555	Note 2
C14	10			TCZ-10	NP0A-100	ZT-541	
C15	1-8			829-7	530-10		
C16	1500			D6-152	GP2L-152	UC-5215	
C17	10000			DD-103	811-01	DC-511	
C18	51			TCZ-51	NP0-338-510	ZT-545	
C19	100			TCZ-100	NP0-337-101	ZT-531	
C20	10000			DD-103	811-01	DC-511	
C21	1000			DD-102	801-001	DC-521	
C22	10000			DD-103	811-01	DC-511	
C23	1500			D6-152	GP2L-152	UC-5215	
C24	10000			DD-103	811-01	DC-511	
C25	470			DD-471	811-471	UC-5347	
C26	10			TCN-10	N750A-100	NT-541	
C27	470			DD-471	811-471	UC-5347	
C28	.05	400		DF-503		PT415	
C29	.05	400		DF-503		PT415	
C30	20000			DD-203	817-02		
C31	1500			D6-152	GP2L-152	UC-5215	
C32	5			TCZ-4R7	NP0A-050	ZT-555	
C33	100			TCZ-100	NP0-337-101	ZT-531	
C34	20			TCZ-20	NP0K-200	ZT-542	
C35	10000			DD-103	811-01	DC-511	
C36	.05	400		DF-503		PT415	
C37	.05	200		DF-503		PT415	

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PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS (cont)

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: ESPEY PART No.	REPLACEMENT DATA: CENTRALAB PART No.	REPLACEMENT DATA: ERIE PART No.	REPLACEMENT DATA: MALLORY PART No.	NOTES
C38A	10000			DD3-103	811-01	DC-511	
B	10000				811-01	DC-511	
C39	10000			DD-103	811-01	DC-511	
C40	10000			DD-103	811-01	DC-511	
C41A	10000			DD3-103	811-01	DC-511	
B	10000			DD3-103	811-01	DC-511	
C42	10000			DD-103	811-01	DC-511	
C43A	300			DD-301	811-301	UC-533	
B	300			DD-301	811-301	UC-533	
C	300			DD-301	811-301	UC-533	
C44	1000			DD-102	801-001	DC-521	
C45	20000			DD-203	817-02	PT412	
C46A	100			‡PC-50	‡1403-01	UC-531	
B	100					UC-531	
C47	20000			DD-203	817-02	PT412	
C48	.05	200		DF-503		PT415	
C49	20000			DD-203	817-02	PT412	
C50	2000			D6-202	801-002	DC-522	
C51	10000			DD-103	811-01	DC-511	
C52	51			TCZ-51	NP0-338-510	ZT-545	
C53	470			DD-471	811-471	UC-5347	
C54	.03	400		DF-303		PT413	
C55	1000			DD-102	801-001	DC-521	
C56	10000			DD-103	811-01	DC-511	
C57	.1	400		DF-104		PT401	
C58	1500			D6-152	GP2L-152	UC-5215	
C59	820	500					
C60	820	500					
C61	.1	400		DF-104		PT401	
C62	3900						
C63	.03	400		DF-303		PT413	
C64	10000			DD-103	811-01	DC-511	
C65	1500			D6-152	GP2L-152	UC-5215	
C66	10000			DD-103	811-01	DC-511	
C67	.25	400				PT4025	

♦ Items C43A, C43B, C43C are combined in one unit.
‡ Items C46A, C46B, and R39 are combined in one unit.
Note 2. Not used in some versions.
Note 3. Some versions may use a 20MMF capacitor in this application.

CONTROLS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	REPLACEMENT DATA: ESPEY PART No.	REPLACEMENT DATA: IRC PART No.	REPLACEMENT DATA: CLAROSTAT PART No.	REPLACEMENT DATA: CENTRALAB PART No.	REPLACEMENT DATA: MALLORY PART No.	INSTALLATION NOTES
R1A	1Meg	½	A9.128	Q13-137	A47-1Meg-Z	B-70-S	U-53	Treble
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R1A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R1A
R2A	1Meg	½	A9.129	Q13-137	A47-1Meg-Z	B-70	U-53	Bass
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R2A
R3A	Switch		B9.311-A					Equalizer Switch
B	500KΩ	½						Volume
R4A	100Ω	2	A9.310-A	W-100	A43-100	VK-121	R100L	Hum balance-wirewound
B	Shaft		Not Req.	Not Req.	FKS-1/4	Not Req.	Not Req.	Attach to R4A

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: ESPEY PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R5	470KΩ	½		BTS-470K	
R6	68Ω	½		BTS-68	
R7	22KΩ	1		BTA-22K	
R8	22KΩ	½		BTS-22K	
R9	150Ω	½		BTS-150	
R10	15KΩ	2		BTB-15K	
R11	910Ω 5%	½		BTS-910 5%	Note 1
R12	22KΩ	½		BTS-22K	
R13	470Ω	½		BTS-470	
R14	10KΩ	1		BTA-10K	Note 1
R15	100Ω	½		BTS-100	
R16	100KΩ	½		BTS-100K	
R17	1Meg	½		BTS-1Meg	
R18	470KΩ	½		BTS-470K	
R19	100Ω	½		BTS-100	
R20	22KΩ	1		BTA-22K	
R21	22KΩ	½		BTS-22K	
R22	150Ω	½		BTS-150	
R23	15KΩ	2		BTB-15K	
R24	68Ω	½		BTS-68	
R25	22KΩ	1		BTA-22K	Note 2
R26	910Ω 5%	½		BTS-910 5%	Note 1

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS (cont)

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA ESPEY PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R27	470KΩ	½		BTS-470K	
R28	220KΩ	½		BTS-220K	
R29	68Ω	½		BTS-68	
R30	22KΩ	1		BTA-22K	
R31	910Ω 5%	½		BTS-910 5%	Note 1
R32	68Ω	½		BTS-68	
R33	68KΩ	½		BTS-68K	
R34	1000Ω	½		BTS-1000	
R35	1500Ω	½		BTS-1500	
R36	6800Ω	½		BTS-6800	
R37	6800Ω	½		BTS-6800	
R38	220KΩ	½		BTS-220K	
R39	47KΩ	½	♦	BTS-47K	
R40	470KΩ	½		BTS-470K	
R41	2.2Meg	½		BTS-2.2Meg	
R42	2.2Meg	½		BTS-2.2Meg	
R43	2.2Meg	½		BTS-2.2Meg	
R44	10Meg	½		BTS-10Meg	
R45	220KΩ	½		BTS-220K	
R46	2.2Meg	½		BTS-2.2Meg	
R47	220KΩ	½		BTS-220K	
R48	1000Ω	½		BTS-1000	
R49	47KΩ	½		BTS-47K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R50	47KΩ	½		BTS-47K	
R51	470KΩ	½		BTS-470K	
R52	1000Ω	½		BTS-1000	
R53	47KΩ	½		BTS-47K	
R54	22KΩ	½		BTS-22K	
R55	47KΩ	½		BTS-47K	
R56	22KΩ	½		BTS-22K	
R57	2700Ω	½		BTS-2700	
R58	220KΩ	½		BTS-220K	
R59	22KΩ	½		BTS-22K	
R60	10Meg	½		BTS-10Meg	Note 3
R61	1800Ω	½		BTS-1800	Note 2
R62	100KΩ	½		BTS-100K	
R63	47KΩ	½		BTS-47K	
R64	100KΩ	½		BTS-100K	
R65	22KΩ	½		BTS-22K	
R66	22KΩ	½		BTS-22K	
R67	100KΩ	½		BTS-100K	
R68	51KΩ 5%	½		BTS-51K 5%	
R69	680KΩ 5%	½		BTS-680K 5%	
R70	2Meg	½		BTS-2Meg	
R71	150KΩ	½		BTS-150K	
R72	22KΩ	½		BTS-22K	

♦ Items R39, C46A and C46B are combined in one unit.
Note 1. Some versions use a 1000Ω resistor in this application.
Note 2. Not used in some versions.
Note 3. Some versions use a 1Meg resistor in this application.

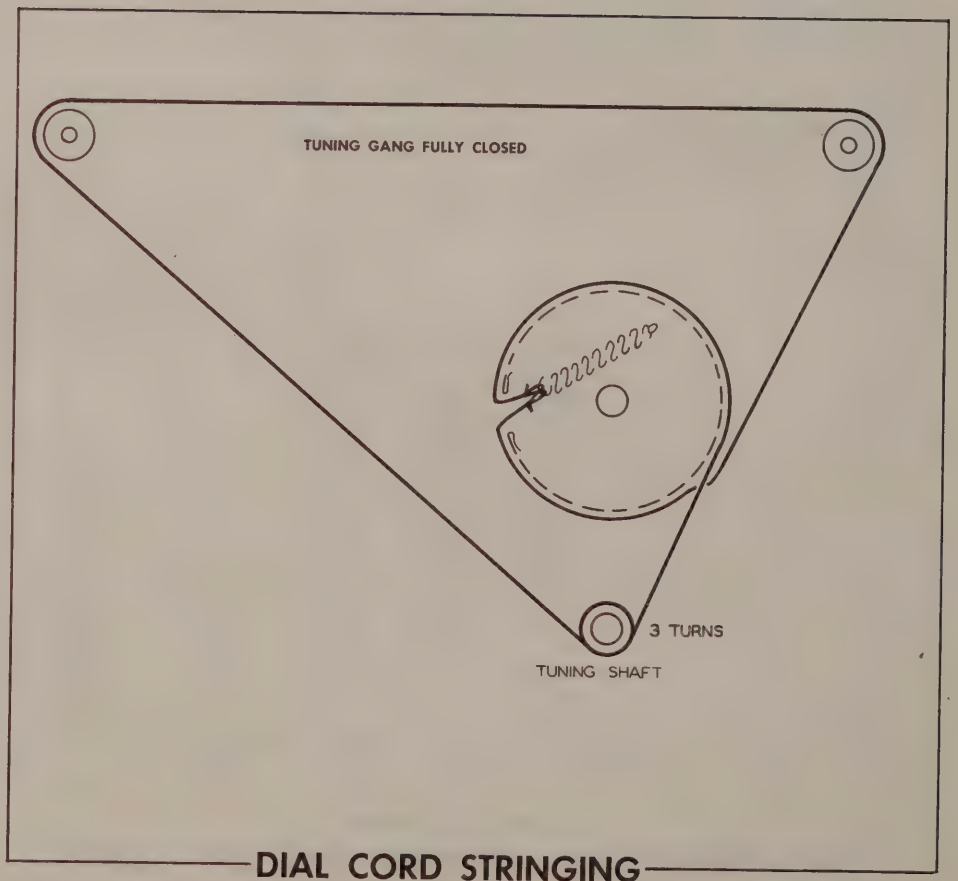
COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA ESPEY PART No.	REPLACEMENT DATA MEISSNER PART No.	REPLACEMENT DATA MERIT PART No.	REPLACEMENT DATA MILLER PART No.	NOTES
L1	FM Ant. Coil	0Ω						Tapped
L2	Fil. Choke	.4Ω			19-1001		4604	1.5 Microhenries
L3	RF Choke	1.1Ω			19-1003		4608	3.6 Microhenries
L4	FM RF Coil	0Ω						Tapped
L5	RF Choke	1.1Ω			19-1003		4608	3.6 Microhenries
L6	FM Osc. Coil	0Ω	0Ω					
L7	Fil. Choke	.4Ω			19-1001		4604	1.5 Microhenries
L8	AM Ant. Coil	.3Ω						
L9	Fil. Choke	.1Ω			19-1001		4604	1.5 Microhenries
L10	AM RF Coil	87Ω	2.2Ω					
L11	AM Osc. Coil	.8Ω	6.8Ω		14-1074	BC-394	70-OSC	
L12	RF Choke	2.3Ω			19-1003		4608	2.7 Microhenries
L13	1st. FM IF	.6Ω	.6Ω	2.415	16-3487	FM-254	1463	
L14	1st. AM IF	9.5Ω	9.5Ω	2.414	16-6758	BC-352	12-C1	
L15	Fil. Choke	.1Ω			19-1001		4604	1.5 Microhenries
L16	2nd. FM IF	.6Ω	.6Ω	2.415	16-3487	FM-254	1463	
L17	2nd. AM IF	9.5Ω	9.5Ω	2.414	16-6758	BC-353	12-C2	
L18	Ratio Det.	1.6Ω	.9ΩCT	2.474	17-3488 *	FM-255	1465	Tertiary winding -.45Ω
L19	Fil. Choke	.4Ω			19-1001		4604	1.5 Microhenries

* Enlarge chassis hole and drill mounting holes.

MISCELLANEOUS

ITEM No.	PART NAME	ESPEY PART No.	NOTES
M1	Dial Light		#47
M2	Dial Light		#47
M3	Tuning Cap.	B6.070	6 Gang (AM Sections - 30-535MMF, 30-535MMF, 30-535MMF)
M4A	Switch		Selector (Rotary - wafer type)
B	Switch		On-off Power (Auxiliary)
A6	Trimmer Cap.	C13518	AM Osc. Padder (500-1000MMF)



DIAL CORD STRINGING

PHOTOFACT* Folder

RETMA MEMBER

FIRESTONE MODELS 13-G-177, 13-G-180, 13-G-181 (Ch. 334-4-AM50A, B, 334-4-AM55A)

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MODEL 13-G-177

FIRESTONE MODELS 13-G-177, 13-G-180, 13-G-181
(Ch. 334-4-AM50A, B, 334-4-AM55A)

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FIRESTONE MODELS 13-G-177, 13-G-180, 13-G-181 (Ch. 334-4-AM50A, B, 334-4-AM55A)

FIRESTONE MODEL 13-G-177 (Code 334-4-21AM50B)

TRADE NAME	Firestone Models 13-G-177, 13-G-180, 13-G-181 (Code 334-4-21AM50A, B, 334-4-21AM55A)
SUPPLIER	Firestone Tire & Rubber Co., 1200 Firestone Parkway, Akron, Ohio
TYPE SET	Television Receiver
TUBES	Twenty-four
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING 1.74 Amp. @ 117 Volts AC
TUNING RANGE—	Channels 2 thru 13 VHF, 14 thru 83 UHF, Video IF 45.75MC, Sound IF 41.25MC (Intercarrier)

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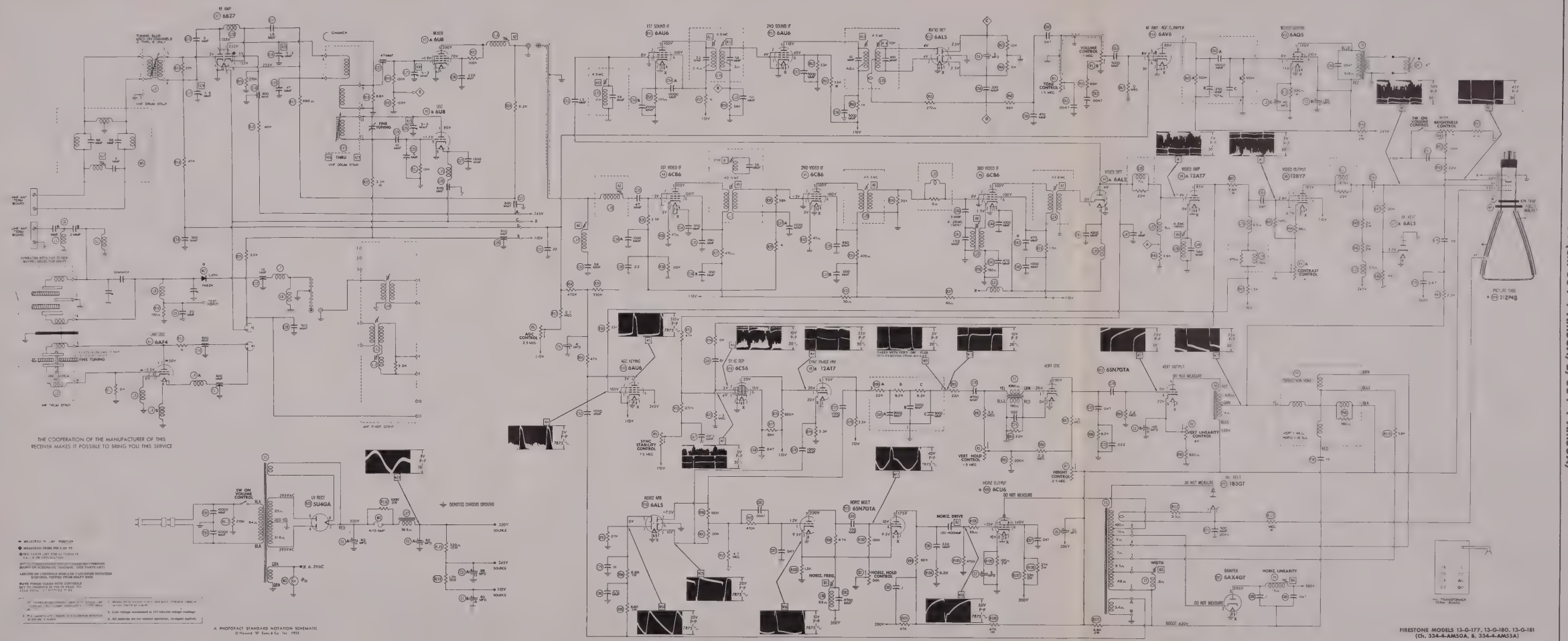

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FIRESTONE MODELS 13-G-177, 13-G-180, 13-G-181 (Ch. 334-4-AM50A, B, 334-4-AM55A)

FIRESTONE MODELS 13-G-177, 13-G-180, 13-G-181 (Ch. 334-4-AM50A, B, 334-4-AM55A)

CHASSIS-TOP VIEW

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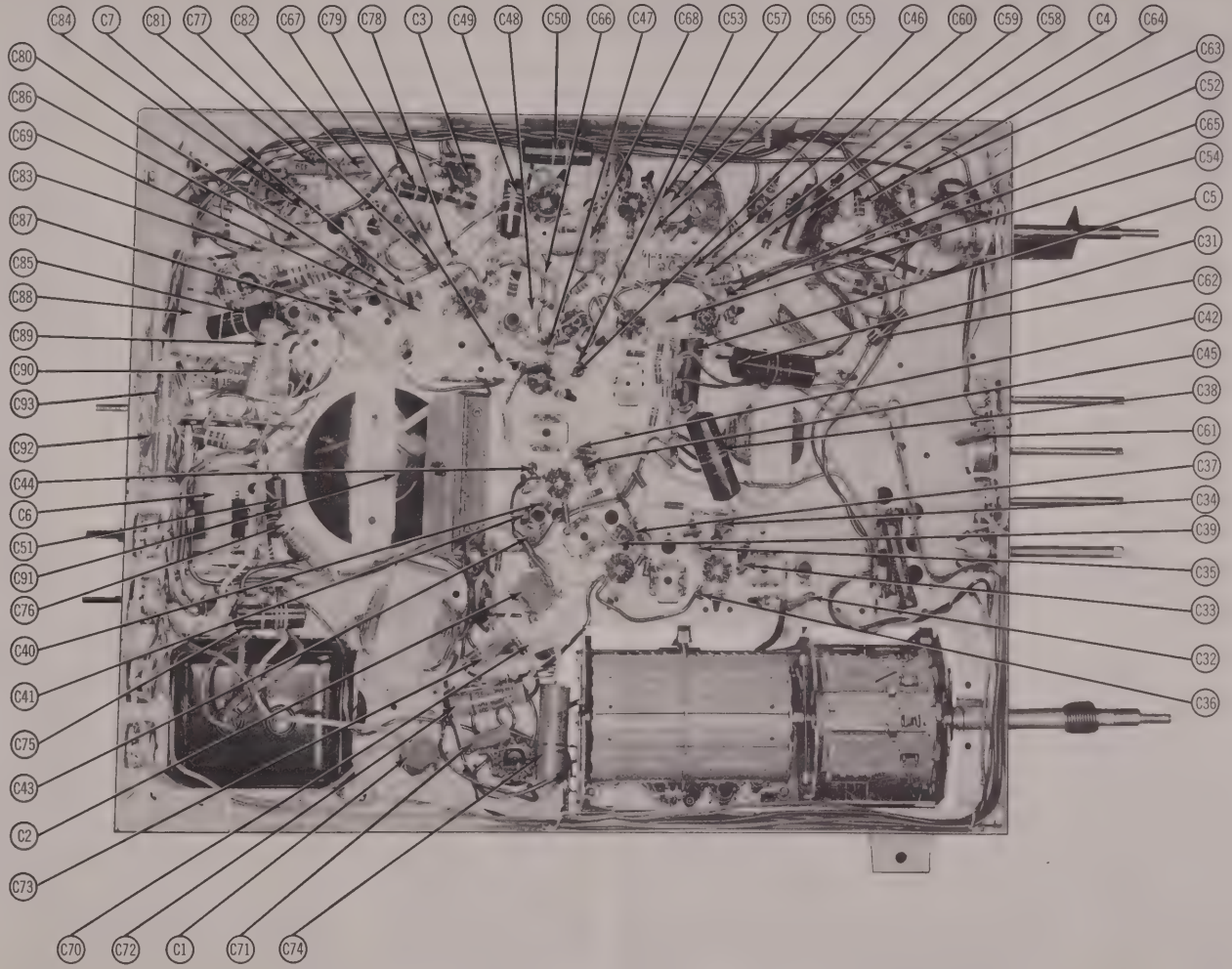
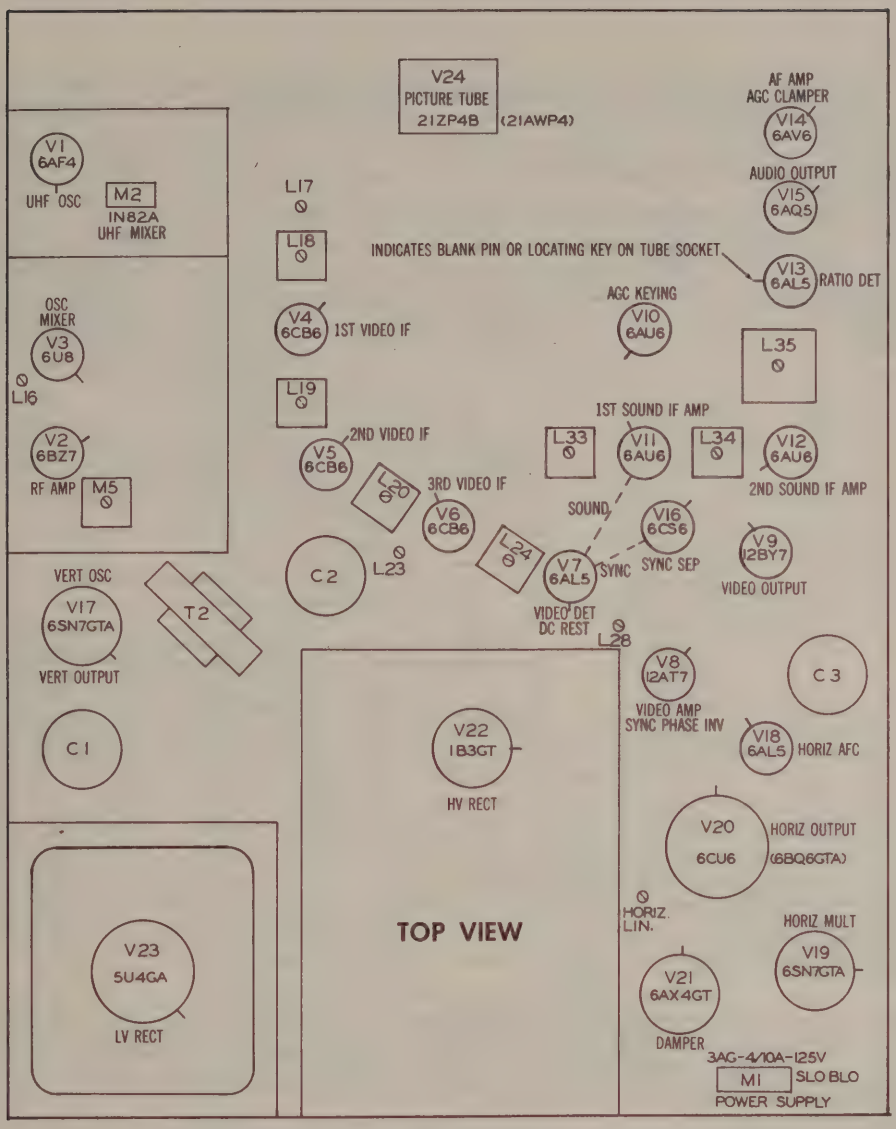


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

POWER SUPPLY FAILURE
No raster, no sound - V23, Fuse (M1)

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V3, V4, V5, V6, V7 (V1 UHF only)
No pic, no sound, has snow - V2, V3, V4
No pic, has sound, has raster - V8, V9, V10, V24
Has pic, no sound - V11, V12, V13, V14, V15
Overloaded picture - V10, V14

SYNC FAILURE
No vert. sync - V8, V17
No horiz. sync - V8, V18, V19
No vert. or horiz. sync - V8, V16

SWEEP FAILURE
No raster, has sound - V19, V20, V21, V22, V24
No vertical deflection - V17
Poor vert. linearity or foldover - V17
Poor horiz. linearity or foldover - V19, V20, V21
Narrow picture - V19, V20, V21, V22, V23
Vert. off freq. - V8, V17
Horiz. off freq. - V8, V18, V19

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ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage lead should be securely taped and kept away from chassis. Do not remove the horizontal multivibrator tube (V10) to disable the high voltage.

VIDEO IF ALIGNMENT

Connect the negative lead of a 1.5 volt battery to the ungrounded side of C34A. Connect the positive lead to chassis. Remove the RF Amplifier Tube (V2) from its socket.
Connect the synchronised sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
①	Direct	High side to an ungrounded tube shield floating over dummy converter tube (V3). Low side to chassis.	44MC (10MC Swp.	41.25MC 45.75MC 47.25MC	Any unused channel	Vert. Amp. thru detector(Fig. 1) to pin 5 (plate) of 6CB6 (V4). Low side to chassis.	A1, A2, A3, A4	Adjust A1 to place 47.25MC marker in trap notch as in Fig. 2. Adjust A2, A3 and A4 for response similar to Fig. 2. A2 and A3 affects flat portion of curve. A4 positions 41.25MC marker. Make sure 45.75MC marker is on peak as shown or the 44.5MC marker on overall response curve (Fig. 3) will be incorrect.
②	"	"	Not used.	42.5MC (Unmod.)	"	Use VTVM DC probe to point Ⓐ. Common to chassis.	A5	Increase bias from 1.5 volts to 4.5 volts at ungrounded side at C34A. Attenuate generator output to maintain 1 volt at VTVM. Adjust for maximum deflection.
③	"	"	"	45.3MC	"	"	A6	"
④	"	"	"	43.9MC	"	"	A7	"
⑤	"	"	"	41.25MC	"	"	A8	Adjust for MINIMUM deflection.
⑥	"	"	44MC (10MC Swp.)	41.25MC 42.25MC 42.5MC 43.9MC 44.5MC 45.3MC 45.75MC 47.25MC	"	Vert. Amp. thru 10KΩ to point Ⓐ. Low side to chassis.		Check for response similar to Fig. 3. SLIGHTLY retouch A5 thru A8 to obtain desired response. If A1 thru A4 requires retouching, step 1 should be repeated. To observe 41.25 and 47.25MC trap markers increase sweep generator output. A7 affects flat portion of curve. A6 affects high frequency side and A5 affects the low frequency side of the response curve.

4.5MC TRAP ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
⑦	10KΩ resistor	High side thru a 10KΩ to pin 2 (plate) of 6AL5 (V7A). Low side to chassis.	4.5MC (Unmod.)	Any conventional channel	DC probe thru detector (Fig. 4) to pin 2 (grid) of picture tube. Common to chassis.	A9	Set contrast control fully clockwise. Adjust for maximum deflection.

ALTERNATE 4.5MC TRAP ALIGNMENT

Replace the RF amplifier tube (V2) and remove bias. Tune in a TV station and adjust A9 for minimum 4.5MC beat interference in picture.

SOUND IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

If a signal generator providing 4.5MC signal of crystal is not available restore the set to normal operating condition and tune in a local TV station. Connect the VTVM and adjust A10 thru A14 as in steps 8, 9 and 10.
Remove 6CB6 (V6) from its socket.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
⑧	10KΩ Resistor	High side thru 10KΩ to pin 2 (plate) of 6AL5 (V7A). Low side to chassis.	4.5MC (Unmod.)	Any	DC probe to point Ⓓ. Common to chassis.	A10, All A12	Adjust for maximum deflection.
⑨	"	"	"	"	DC probe to point Ⓒ. Common to chassis.	A13	Use only enough signal generator output to provide useable indication at VTVM. Adjust for maximum deflection
⑩	"	"	"	"	DC probe to point Ⓑ. Common to chassis.	A14	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting. Replace V6 in its socket.

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Remove 6CB6 (V6) from its socket.
Use frequency modulated signal with 60% modulation and 450KC sweep. Use 120% sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
⑧	10KΩ resistor	High side thru 10KΩ to pin 2 (plate) of 6AL5 (V7A). Low side to chassis.	4.5MC (450KC Swp.	4.5MC	Any	Vert. Amp. to point Ⓓ. Low side to chassis.	A10, All A12	Adjust for curve of maximum amplitude and symmetry similar to Fig. 5.
⑨	"	"	"	"	"	Vert. Amp. to point Ⓒ. Low side to chassis.	A13	Disconnect stabilizing capacitor C4. Use only enough sweep generator output to provide useable indication on scope. Adjust for curve of maximum amplitude and symmetry similar to Fig. 5.
⑩	"	"	"	"	"	Vert. Amp. to point Ⓑ. Low side to chassis.	A14	Reconnect stabilizing capacitor C4. Adjust so that 4.5MC occurs at center of crossover frequency as in Fig. 6. SLIGHTLY retouch A13 for maximum amplitude and straightness of crossover lines. Replace V6 in its socket.

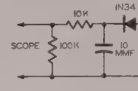


FIG. 1

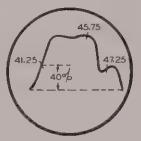


FIG. 2

FIG. 3

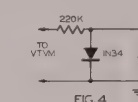


FIG. 4

FIG. 5

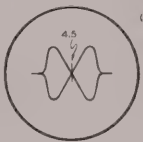


FIG. 6

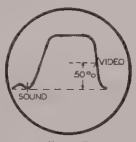


FIG. 7

FIG. 8

VHF OSCILLATOR ALIGNMENT

Connect the negative lead of a 4.5 volt battery to the ungrounded side of C34A. Connect the positive lead to chassis.
Complete oscillator alignment may not be necessary. If the oscillator seems to be off frequency approximately the same amount for a majority of the channels it may be possible to correct them in one step using A15. It should be noted that this is an all channel oscillator adjustment and should not be used to correct any individual channel. If adjustment of A15 will not bring all channels well within the range of the fine tuning control it will be necessary to adjust the channel strip adjustment screw for each channel that is off frequency. The channel oscillator adjustment screws are reached through a hole just to the left of the channel switch shaft (hole extends through UHF tuner).
The correct adjustment screw is accessible through this hole as the channel switch is turned to each channel.
Connect the synchronised sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
(11)	Two 120Ω Carbon Resistors	Across VHF Antenna terminals with 120Ω in each lead.	213MC (10MC Swp.	211.25MC 215.75MC	13	Vert. Amp. thru 10KΩ to point Ⓐ. Low side to chassis.	A18	Adjust to place marker in trap notch as in Fig. 7. Video marker should be at 50%.
			207MC (10MC Swp.)	205.75MC 209.75MC	12		A17	
			201MC (10MC Swp.)	199.25MC 203.75MC	11		A18	
			195MC (10MC Swp.)	193.25MC 197.75MC	10		A19	
			189MC (10MC Swp.	187.25MC 191.75MC	9		A20	
			183MC (10MC Swp.	181.25MC 185.75MC	8		A21	
			177MC (10MC Swp.)	175.25MC 179.75MC	7		A22	
			85MC (10MC Swp.)	83.25MC 87.75MC	6		A23	
			79MC (10MC Swp.)	77.25MC 81.75MC	5		A24	
			69MC (10MC Swp.)	67.25MC 71.75MC	4		A25	
			63MC (10MC Swp.)	61.25MC 65.75MC	3		A26	
			57MC (10MC Swp.)	55.25MC 59.75MC	2		A27	

VHF RF AND MIXER ALIGNMENT

Connect the negative lead of a 3 volt battery to the ungrounded side of C3). Connect the positive lead to chassis.
Connect the synchronised sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
(12)	Two 120Ω Carbon Resistors	Across VHF Antenna terminals with 120Ω in each lead.	207MC (10MC Swp.)	205.25MC 209.75MC	12	Vert. Amp. thru 10KΩ to point Ⓐ. Low side to chassis.	A28, A29 A30	Adjust for response similar to Fig. 8, with markers above 90%.
(13)	"	"	213MC (10MC Swp.	211.25MC 215.75MC	13	"		If markers fall below 70% on any channel, make compromise adjustments of A28, A29 and A30 with channel switch set to that channel. Then check all other channels to see that they have not been seriously affected
			201MC (10MC Swp.)	199.25MC 203.75MC	11			
			195MC (10MC Swp.)	193.25MC 197.75MC	10			
			189MC (10MC Swp.)	187.25MC 191.75MC	9			
			183MC (10MC Swp.)	181.25MC 185.75MC	8			
			177MC (10MC Swp.)	175.25MC 179.75MC	7			
			85MC (10MC Swp.)	83.25MC 87.75MC	6			
			79MC (10MC Swp.)	77.25MC 81.75MC	5			
			69MC (10MC Swp.)	67.25MC 71.75MC	4			
			63MC (10MC Swp.)	61.25MC 65.75MC	3			
			57MC (10MC Swp.)	55.25MC 59.75MC	2			

IF WAVE TRAP ADJUSTMENT

The IF wave trap should be tuned to minimize interference caused by signals which fall within the video IF band-pass (40-48MC). Tune in a station on which the interference is noted and adjust A31 for minimum interference in the picture.

UHF OSCILLATOR ADJUSTMENT

The UHF oscillator channel strip adjustment screws are reached through the same hole provided for VHF channel oscillator adjustment screws. Tune in all UHF stations available and check each one to see if the fine tuning control can be tuned through a point where clearest picture and best sound occur. If the fine tuning control does not have sufficient range on any UHF channel strip set the fine tuning control to its mid-range position and then adjust the UHF channel strip oscillator screw for clearest picture and best sound.

UHF RF ALIGNMENT

The UHF RF portion of this receiver has been properly aligned at the factory and is very stable.
Alignment of this portion is not recommended in the field.

PROPERTY OF
L I [illegible] SHIP
[illegible] ST.
DIXIE, [illegible]

FIRESTONE MODELS 13-G-177, 13-G-180, 13-G-181 (Ch. 334-4-AM50A, B; 334-4-AM55A)

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

TRUCTIONS

.001 MFD
TO RCVR
330 Ω

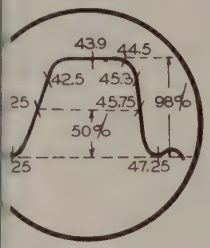


FIG. 3

100MMF
TO PIN 2 GRID OF PICTURE TUBE
220K

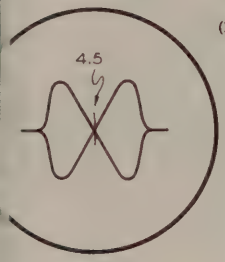


FIG. 6

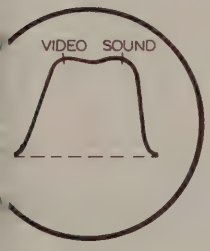


FIG. 8

VHF OSCILLATOR ALIGNMENT

Connect the negative lead of a 4.5 volt battery to the ungrounded side of C34A. Connect the positive lead to chassis.
Complete oscillator alignment may not be necessary. If the oscillator seems to be off frequency approximately the same amount for a majority of the channels it may be possible to correct them in one step using A15. It should be noted that this is an all channel oscillator adjustment and should not be used to correct any individual channel. If adjustment of A15 will not bring all channels well within the range of the fine tuning control it will be necessary to adjust the channel strip adjustment screw for each channel that is off frequency. The channel oscillator adjustment screws are reached through a hole just to the left of the channel switch shaft (hole extends through UHF tuner).
The correct adjustment screw is accessible through this hole as the channel switch is turned to each channel.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
(11)	Two 120Ω Carbon Resistors	Across VHF Antenna terminals with 120Ω in each lead.	213MC (10MC Swp.	211. 25MC 215. 75MC	13	Vert. Amp. thru 10KΩ to point (A). Low side to chassis.	A16	Adjust to place marker in trap notch as in Fig. 7. Video marker should be at 50%.
			207MC (10MC Swp.)	205. 25MC 209. 75MC	12		A17	
			201MC (10MC Swp.)	199. 25MC 203. 75MC	11		A18	
			195MC (10MC Swp.)	193. 25MC 197. 75MC	10		A19	
			189MC (10MC Swp.	187. 25MC 191. 75MC	9		A20	
			183MC (10MC Swp.)	181. 25MC 185. 75MC	8		A21	
			177MC (10MC Swp.)	175. 25MC 179. 75MC	7		A22	
			85MC (10MC Swp.)	83. 25MC 87. 75MC	6		A23	
			79MC (10MC Swp.)	77. 25MC 81. 75MC	5		A24	
			69MC (10MC Swp.)	67. 25MC 71. 75MC	4		A25	
			63MC (10MC Swp.)	61. 25MC 65. 75MC	3		A26	
			57MC (10MC Swp.)	55. 25MC 59. 75MC	2		A27	

VHF RF AND MIXER ALIGNMENT

Connect the negative lead of a 3 volt battery to the ungrounded side of C31. Connect the positive lead to chassis.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
(12)	Two 120Ω Carbon Resistor	Across VHF Antenna terminals with 120Ω in each lead.	207MC (10MC Swp.)	205. 25MC 209. 75MC	12	Vert. Amp. thru 10KΩ to point (E). Low side to chassis.	A28, A29 A30	Adjust for response similar to Fig. 8, with markers above 90%.
(13)	"	"	213MC (10MC Swp.	211. 25MC 215. 75MC	13	"		If markers fall below 70% on any channel, make compromise adjustments of A28, A29 and A30 with channel switch set to that channel. Then check all other channels to see that they have not been seriously affected.
			201MC (10MC Swp.)	199. 25MC 203. 75MC	11			
			195MC (10MC Swp.)	193. 25MC 197. 75MC	10			
			189MC (10MC Swp.)	187. 25MC 191. 75MC	9			
			183MC (10MC Swp.)	181. 25MC 185. 75MC	8			
			177MC (10MC Swp.)	175. 25MC 179. 75MC	7			
			85MC (10MC Swp.)	83. 25MC 87. 75MC	6			
			79MC (10MC Swp.)	77. 25MC 81. 75MC	5			
			69MC (10MC Swp.)	67. 25MC 71. 75MC	4			
			63MC (10MC Swp.)	61. 25MC 65. 75MC	3			
			57MC (10MC Swp.)	55. 25MC 59. 75MC	2			

IF WAVE TRAP ADJUSTMENT

The IF wave trap should be tuned to minimize interference caused by signals which fall within the video IF band-pass (40-48MC). Tune in a station on which the interference is noted and adjust A31 for minimum interference in the picture.

UHF OSCILLATOR ADJUSTMENT

The UHF oscillator channel strip adjustment screws are reached through the same hole provided for VHF channel oscillator adjustment screws. Tune in all UHF stations available and check each one to see if the fine tuning control can be tuned through a point where clearest picture and best sound occur. If the fine tuning control does not have sufficient range on any UHF channel strip set the fine tuning control to its mid-range position and then adjust the UHF channel strip oscillator screw for clearest picture and best sound.

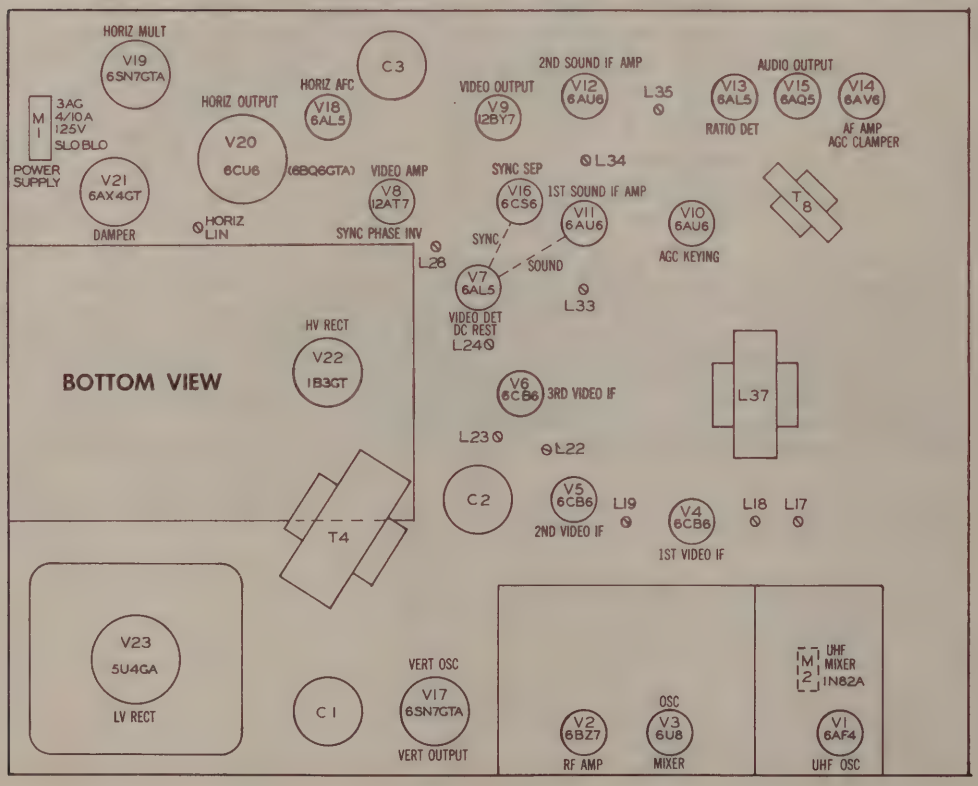
UHF RF ALIGNMENT

The UHF RF portion of this receiver has been properly aligned at the factory and is very stable.
Alignment of this portion is not recommended in the field.

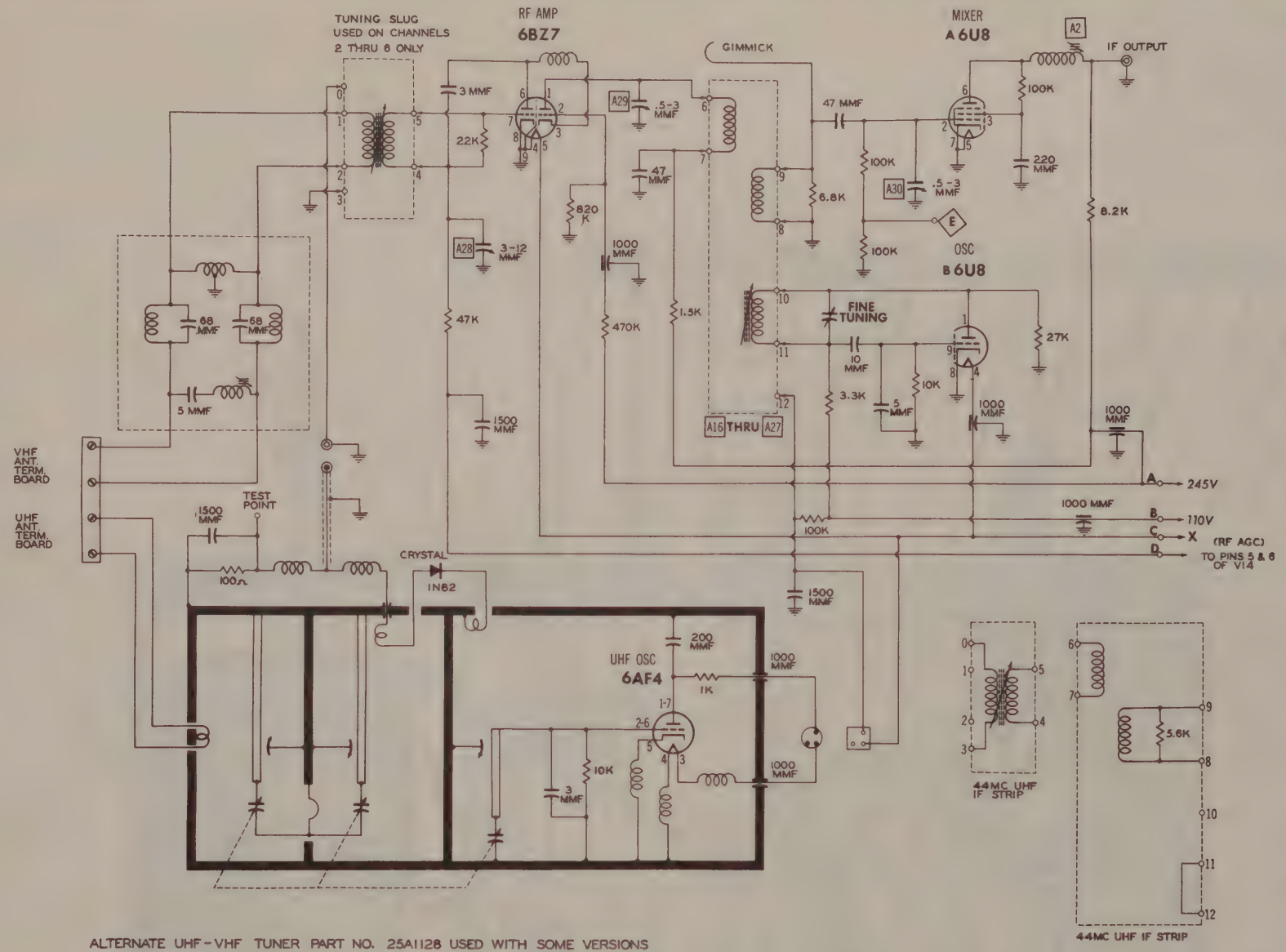
RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6AF4	*†6.3KΩ	10KΩ	.1Ω	0Ω	0Ω	10KΩ	*†6.3KΩ		
V 2	6BZ7	†1.1KΩ	130KΩ	Inf.	0Ω	.1Ω	Inf.	950KΩ	0Ω	†1.1KΩ
V 3	6U8	†5.3KΩ	200KΩ	†110KΩ	.1Ω	0Ω	†8.5KΩ	0Ω	0Ω	10KΩ
V 4	6CB6	100KΩ	47Ω	0Ω	.1Ω	†2.8KΩ	†2.8KΩ	0Ω		
V 5	6CB6	100KΩ	47Ω	0Ω	.1Ω	†2.7KΩ	†2.7KΩ	0Ω		
V 6	6CB6	.2Ω	180Ω	0Ω	.1Ω	†3.5KΩ	†3.5KΩ	0Ω		
V 7	6AL5	1Meg	3.9KΩ	.1Ω	0Ω	.5Ω	0Ω	0Ω		
V 8	12AT7	†9KΩ	3.9KΩ	.3Ω	0Ω	0Ω	†5.3KΩ	†820KΩ	3.3KΩ	.1Ω
V 9	12BY7	250Ω	1Meg	0Ω	.1Ω	.1Ω	0Ω	†4.3KΩ	†2.1KΩ	0Ω
V 10	6AU6	†35KΩ	†2.1KΩ	.1Ω	0Ω	500KΩ	†400Ω	†2.1KΩ		
V 11	6AU6	2Ω	0Ω	0Ω	.1Ω	†3KΩ	†3KΩ	100Ω		
V 12	6AU6	56KΩ	0Ω	.1Ω	0Ω	†3KΩ	†.8KΩ	0Ω		
V 13	6AL5	Inf.	Inf.	.1Ω	0Ω	10KΩ	0Ω	10KΩ		
V 14	6AV6	10Meg	0Ω	.1Ω	0Ω	900KΩ	900KΩ	†500KΩ		
V 15	6AQ5	500KΩ	330Ω	0Ω	.1Ω	†1.9KΩ	†1.4KΩ	500KΩ		
V 16	6CS6	50KΩ	0Ω	.1Ω	0Ω	†820KΩ	†70KΩ	1.5Meg		
V 17	6SN7GTA	4.5Meg	▲2.5Meg	190Ω	2.2Meg	▲8.5KΩ	2.5KΩ	0Ω	.1Ω	
V 18	6AL5	4.8Meg	4.8Meg	.1Ω	0Ω	10KΩ	NC	10KΩ		
V 19	6SN7GTA	5Meg	†4.8KΩ	1.5KΩ	200KΩ	†230KΩ	1.5KΩ	.1Ω	0Ω	
V 20	6CU6	TP	0Ω	TP	†16KΩ	470KΩ	TP	.1Ω	100Ω	TOP CAP ▲15Ω
V 21	6AX4GT	TP	NC	1.5Meg	TP	†60Ω	NC	.1Ω	0Ω	
V 22	1B3GT		PINS	1-8	HAVE	INF	RESISTANCE			TOP CAP ▲435Ω
V 23	5U4GA	Inf.	45KΩ	Inf.	20Ω	Inf.	22Ω	Inf.	45KΩ	
V 24	21ZP4B	0Ω	1.1Meg	PIN 10 ▲6.8KΩ	PIN 11 †240KΩ	PIN 12 .1Ω				

*MEASURED IN "UHF" POSITION.
†MEASURED FROM PIN 2 OF V23.
▲MEASURED FROM PIN 3 OF V21.
TP-TIE POINT.
NC-NO CONNECTION.
ALL MEASUREMENTS TAKEN IN "VHF" POSITION UNLESS OTHERWISE DESIGNATED.



TUBE PLACEMENT CHART

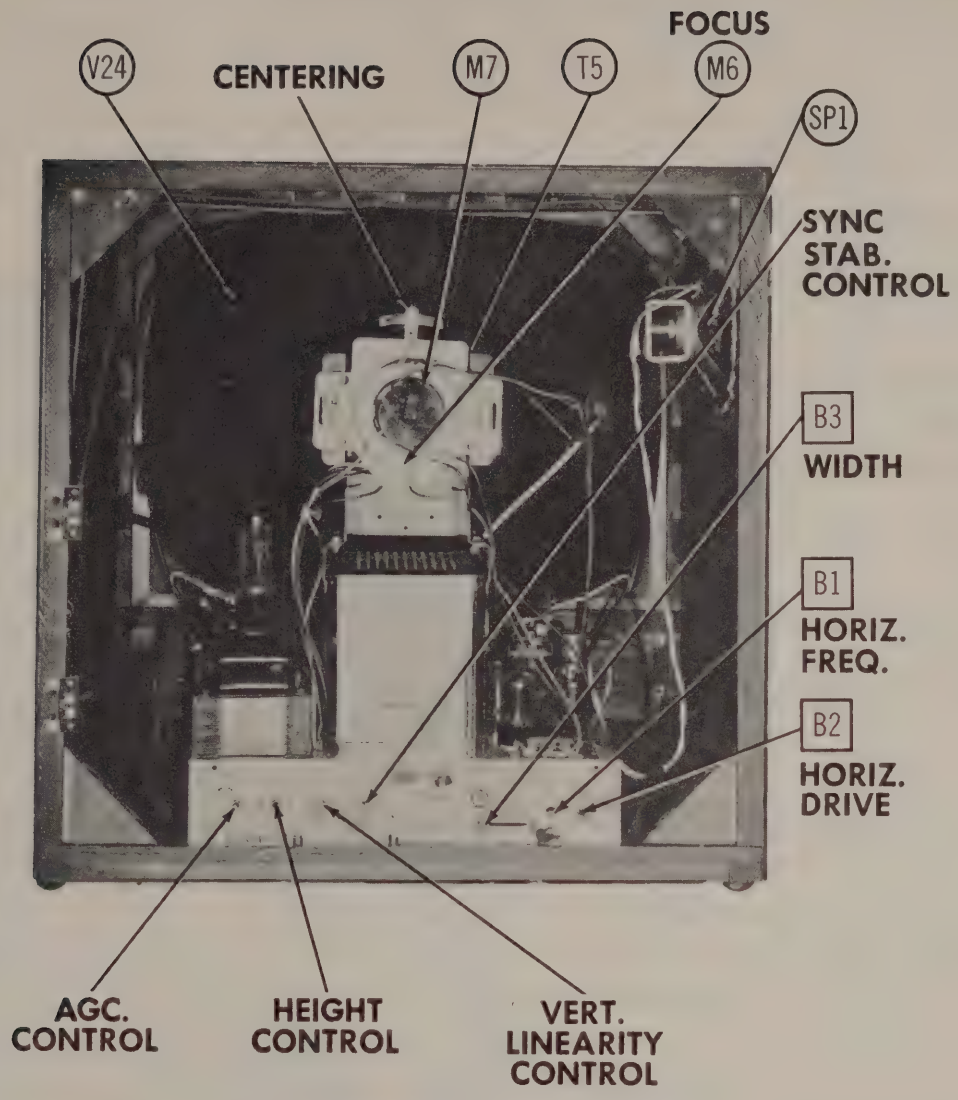


ALTERNATE UHF-VHF TUNER PART NO. 25A1128 USED WITH SOME VERSIONS

A PHOTOFACT STANDARD NOTATION SCHEMATIC

© Howard W. Sams & Co., Inc. 1955

ALTERNATE TUNER SCHEMATIC



CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern.

Set the horizontal hold control to its mid-range position and adjust the horizontal frequency slug (B1) until picture synchronizes horizontally. Switch off channel and back again. The picture should pull into sync and remain in sync thru 90 degree rotation of horizontal hold control.

Turn the contrast control maximum counter clockwise and adjust the brightness control for a washed out picture.

Adjust the horizontal drive trimmer (B2) clockwise as far as possible without the presence of a vertical white line near the center of the raster.

Adjust the width coil (B3) for a picture slightly wider than necessary to fill the picture mask horizontally.

Adjust the horizontal linearity coil (B4) for a picture that is symmetrical from left to right.

Recheck setting of B2, then repeat horizontal oscillator adjustment (B1) as above.

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage."

INSUFFICIENT SWEEP

Check by substitution V20, V21 and V23. Check adjustments B2, B3 and B4. Check T3, T5A, R107, R108, R104, C86 and other associated components.

DRIVE LINES

Check by substitution V20 and V21. Check adjustments B2 and B4. Check R107, R108, T3, T5A and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V20 and V21. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines."

PIE CRUST EFFECT

Check by substitution V19, V20 and V21. Check C82 for open. Check L36, C81, R92, R98 and other associated components.

XMAS TREE EFFECT

Check by substitution V19, V20 and V21. Check T3 and T5 for internal arcing. Check L36, C83, C80, R94, R95, R103 and other associated components.

VERTICAL

LOSS OF SWEEP

Substitute V17. Check waveform W11.

If Satisfactory	If Unsatisfactory
Check T4, T5B, R111, R89, C2B and other associated components.	Check T2, C74, R7, R87 and other associated components.

INSUFFICIENT SWEEP

Substitute V17. Check height and vertical linearity controls for proper operation. Check R87, T4 and other associated components.

COMPRESSED AT BOTTOM

Substitute V17. Check R87, R7, C74 and other associated components.

COMPRESSED AT TOP

Substitute V17. Check R89, R8, C2B, T4 and other associated components.

FOLDS

Substitute V17. Check C72, C73, R88, T2, T4, T5B and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Check by substitution V16 and V8. Check C66, C68, R76, R77, R78 and other associated components.

LOSS OF VERTICAL SYNC-HORIZONTAL SYNC SATISFACTORY

Substitute V17. Check vertical integrator network. Check C70, C71, R83, T2 and other associated components.

LOSS OF HORIZONTAL SYNC-VERTICAL SYNC SATISFACTORY

Check by substitution V18 and V19. Check C77, C78, C81, C82, C83, R92, R98 and other associated components.

HORIZONTAL BENDING

Check by substitution V8, V16, V18 and V19. Check horizontal AFC network.

VIDEO

LOSS OF VIDEO

Check by substitution V8 and V9. Check C49, C50, R42, R41, R45, R46, L29, L32 and other associated components.

SOUND BARS (4.5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check adjustment A9. Check video IF alignment.

POOR CONTRAST

Check by substitution V8 and V9. Check contrast control. Check L26, L30, L31, C49, C50 and other associated components.

NEGATIVE PICTURE

Check by substitution V8 and V9. Check picture tube. Check C49, C50 and other associated components.

SMEAR

Check by substitution V8 and V9. Check L26, L27, L29, L30, L31, R45, R46, C49, C50 and other associated components.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V2, V4, V5, V6, V7, V8 and V9 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V11, V12, V13, V14 and V15. Check stages V14 and V15 using audio signal generator. Apply audio signal across R1B.

If Satisfactory	If Unsatisfactory
Check ratio detector and audio IF stages for component failure or change of value.	Check C60, C63, C64, C65, C3C, R69, R71, R70, T8, speaker and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustment A14 for minimum buzz. If still unsatisfactory, check audio IF alignment.

DISTORTED

Follow procedure outlined under "Weak or no Sound."

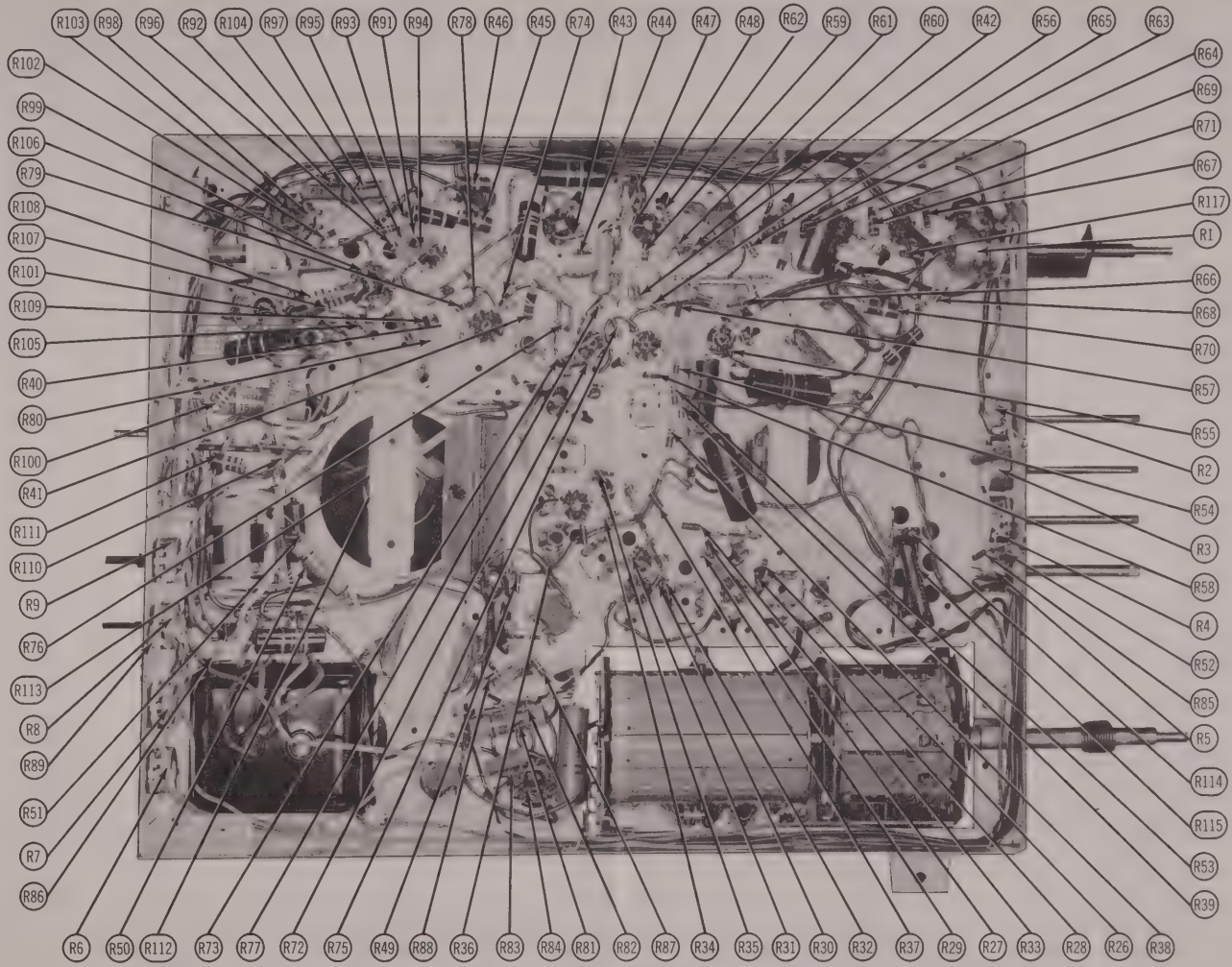
POWER

DEAD SET

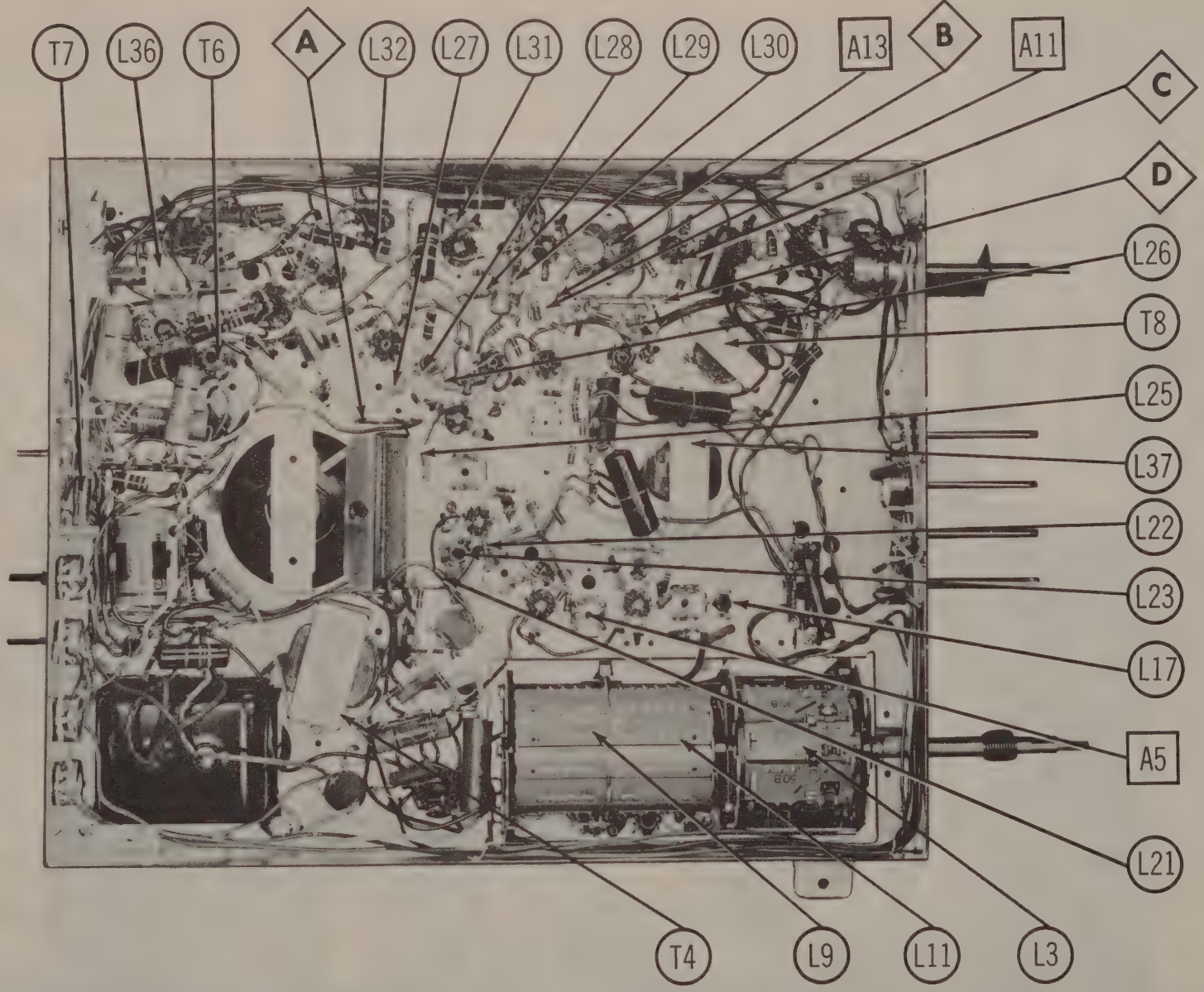
If filaments fail to light, check AC interlock assembly. Check switch on volume control and T1. If filaments light, substitute V23. Check B+ filter and decoupling network.

SMALL AND/ON DIM PICTURE

Substitute V23. Check B+ filter and decoupling network.



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION



CHASSIS BOTTOM VIEW-TRANS., INDUCTOR AND ALIGNMENT IDENTIFICATION

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: FIRESTONE PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	UHF Osc.	6AF4	6AF4	7DK	
V2	VHF RF Amp.	6BZ7	6BZ7	9AJ	
V3	VHF Mixer-Osc.	6U8	6U8	9AE	
V4	1st. Video IF Amp.	6CB6	6CB6	7CM	
V5	2nd. Video IF Amp.	6CB6	6CB6	7CM	
V6	3rd. Video IF Amp.	6CB6	6CB6	7CM	
V7	Video Det.- DC Restorer	6AL5	6AL5	6BT	
V8	Video Amp.- Sync Phase Inv.	12AT7	12AT7	9A	
V9	Video Output	12BY7	12BY7	9BF	
V10	AGC Keying	6AU6	6AU6	7BK	
V11	1st. Sound IF Amp.	6AU6	6AU6	7BK	
V12	2nd. Sound IF Amp.	6AU6	6AU6	7BK	
V13	Ratio Det.	6AL5	6AL5	6BT	
V14	AF Amp.- AGC Clamper	6AV6	6AV6	7BT	
V15	Audio Output	6AQ5	6AQ5	7BZ	
V16	Sync Separator	6CS6	6CS6	7CH	
V17	Vert. Osc.- Vert. Output	6SN7GTA	6SN7GTA	8BD	
V18	Horiz. AFC	6AL5	6AL5	6BT	
V19	Horiz. Mult.	6SN7GTA	6SN7GTA	8BD	
V20	Horiz. Output	6CU6	6CU6	6AM	6BQ6TA used as alternate
V21	Damper	6AX4GT	6AX4GT	4CG	
V22	HV Rectifier	1B3GT	1B3GT	3C	
V23	LV Rectifier	5U4GA	5U4GA	5T	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA: FIRESTONE PART No.	CBS PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.	RETMA BASE TYPE	NOTES
V24	21ZP4B ①	21ZP4B ①	21ZP4B ①	21ZP4B ②	21ZP4B ①	12N	① Aluminized
		21ZP4A	21ZP4A	21ZP4A	21ZP4A	12N	② Silver Screen
				21ZP4 ③		12D	③ Circuit Change Necessary
	21AWP4	21AWP4			21AWP4	12N	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: FIRESTONE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C1A	▲80	400	45X390	FP229.4	TM-D80-450	T-180	
B	▲60	400					
C2A	▲80	400	45X391	FP229.8	TM-3057	T-720	
B	▲100	50					
C3A	■20	400	45X392		TM-D20-450	D-215	
B	▲20	400			TD-50-50	MT-0550	
C	40	50					
C4	5	25	45X378	TC30	TD-5-25	MMT-0505	
C5	4	100	45X361	TC40	TD-4-150	MT-1504	
C6	30	400	45X393	TC77	TD-30-450	FM-4530	
C7	5	25	45X378	TC30	TD-5-25	MMT-0505	

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: FIRESTONE PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	NOTES
C8A	1						
B	2						
C9	120			DD-121	811-121	UC-5312	
C10	800		13M-23E801Z	MFT-1000			
C11	800		13M-23E801Z	MFT-1000			
C12	10		13M-20A-100D-N-1				
C13	3-8			829-10			
C14	1500		13L-8XA152Z	DD-152	801-0015	DC-5215	
C15	3		13L-8C030H	TCZ-3R3	NP0A-030	ZT-5533	
C16	.5-3		31A-056-1	829-3	3115-01-0R5	CT565A	
C17	1.5		13L-83IR5C	TCZ-IR5	NP0A-IR5	ZT-5515	
C18	800		13M-23E801Z				
C19	47		13L-80470K	DD-470	831-470	UC-5447	
C20	800		13M-23E801Z				
C21	800		13M-23E801Z				
C22	47		13M-20U470K	MFT-50			
C23	.5-3		31A-056-1	829-3	3115-01-0R5	CT565A	
C24	10		13L-8U100F	TCN-10	N750K-100	NT-541	
C25	5		13L-8UA050C				
C26	.5-3		31A-056-1	829-3	3115-01-0R5	CT565A	
C27	1500		13L-8XA152Z	DD-152	801-0015	DC-5215	
C28	1500		13L-8XA152Z	DD-152	801-0015	DC-5215	
C29	800		13M-23E801Z				
C30	220		13L-12D221K	DD-221	811-221	UC-5322	
C31	.22	200	RCP10M2224M			PT4022	
C32	36		47X626				
C33	47		47X603	D6-470	GP1K-470	UC-5447	
C34A	1000		80X3	DD2-102	812-001	DCD-521	
B	1000						
C35	680		80X5	DD-681	811-681	UC-5368	
C36	1000		80X1	DD-102	801-001	DC-521	
C37A	1000		80X3	DD2-102	812-001	DCD-521	
B	1000						
C38	.22	200	RCP10M2224M			PT4022	
C39	680		80X5	DD-681	811-681	UC-5368	
C40	1.5		47X584	TCZ-IR5	NP0A-IR5	ZT-5515	
C41	150	500	RCM15E151K	D6-151	811-151	MCB236	
C42	470		80X4	DD-471	831-471	UC-5347	Note 1
C43	470		80X4	DD-471	831-471	UC-5347	
C44	1000		80X1	DD-102	801-001	DC-521	
C45	1000		80X1	DD-102	801-001	DC-521	

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

CAPACITORS (cont)

ITEM No	RATING CAP	RATING VOLT	REPLACEMENT DATA FIRESTONE PART No	CENTRALAB PART No	ERIE PART No	MALLORY PART No	NOTES
C46	1000		80X1	DD-102	801-001	DC-521	
C47	5		47X582	TCZ-4R7	MPGA-050	ZT-555	
C48	360	500	47X588	TCH-360	M750-333-3[illegible]		
C49	.047	400	RCP10M44739M	DF-509		PT4147	
C50	.1	400	RCP10M44394M	DF-104		PT401	
C51	.1	200	RCP10M21044M	DF-104		PT401	
C52	1000		80X1	DD-102	801-001	DC-521	
C53	1.5		47X564	TCZ-2R5	M70A-2R5	ZT-5515	
C54A	10000		80X8	DD3-103	811-01 [illegible]	DC-511	
B	10000				811-01 [illegible]	DC-511	
C55	100		47X804	D6-101	GP1K-101	UC-531	
C56	5000		47X507	DD-502	811-005	DC-521	
C57	5000		47X507	DD-502	811-005	DC-521	
C58	330	500	47X970	D6-331	831-331	UC-5333	
C59	470	500	47X525	D6-471	831-471	UC-5347	
C60	.047	400	RCP10M44733M	DF-503		PT4147	
C61	.0047	400	RCP10M44723M	D6-472	GP3-333-472	PT6347	
C62	.0047	400	RCP10M44723M	D6-472	GP3-333-472	PT6347	
C63	5000		47X507	DD-502	811-005	DC-525	
C64A	10000						
B	250		†7X625	†PC-80	†3404-01		
C							
C65	.0047	500	RCP10M64723M	D6-472	GP3-333-472	PT6347	
C66	.01	400	RCP10M41033M	D6-103	GP3-333-103	PT611	
C67	1000		80X1	DD-102	801-001	DC-521	
C68	.047	400	RCP10M44739M	DF-503		PT4147	
C69A	2000					DC-523	
B	5000		◆7X27	◆PC-100	◆1605-01	DC-525	
C	5000					DC-525	
C70	4700	500	47X543			MC2465	
C71	.033	200	RCP10M23233M	DF-303	S17-02	PT4123	
C72	.047	600	RCP10M64739M	DF-503		PT6147	
C73	.033	200	RCP10M23233M	DF-303	S17-02	PT4123	
C74	.1	600	RCP10M61044M	DF-104		PT601	
C75	.047	600	RCP10M64739M	DF-503		PT6147	
C76	.015	600	RCP10M61533M	DD6-153		PT6115	
C77	1000		80X1	DD-102	801-001	DC-521	
C78	1000		80X1	DD-102	801-001	DC-521	
C79	.01	400	RCP10M41023M	D6-103	GP3-333-103	PT611	
C80	270	500	RCM36A271E	D6-271	GP3K-271	MC241	
C81	.0047	400	RCP10M44723M	D6-472	GP3-333-472	PT6347	
C82	.047	200	RCP10M23473M	DF-503		PT4147	
C83	4700	500	47X543			MCE465	
C84	390	500	RCM20S391J	TCN-390	N750-334-392	MCE243	
C85	.1	400	RCP10M44104M	DF-104		PT401	
C86	330	500	47X570	D6-331	831-331	PT6347	
C87	.047	400	RCP10M44733M	DF-503		PT4147	
C88	.1	400	RCP10M44104M	DF-104		PT401	
C89	.047	400	RCP10M44733M	DF-503		PT4147	
C90	.15	400	RCP10M44154M			PT4015	
C91	500	20000	47X560	TY3-502	422	HV10035A	
C92	10000		47X915	DD-103	811-01	DC-511	
C93	10000		47X915	DD-103	811-01	DC-511	

Note 1. Some versions use 680MMF in this application (part #80X5).
† Items C64A, C64B, C64C, R65A and R65B are combined in one unit.
When replacing items separately, C64B and C64C should total 250MMF.
◆ Items C68A, C68B, C69C, R80A, R80B and R80C are combined in one unit.

CONTROLS

ITEM No	RATING RESIST. ance	RATING WATTS	REPLACEMENT DATA FIRESTONE PART No	IRC PART No	CLAROSTAT PART No	CENTRALAB PART No	MALLORY PART No	INSTALLATION NOTES
R1A	100Ω	½	78X31	◆QJ-638	RTV-502	F1-4	UP31L	Contrast (Front)
B	1Meg	½				R2-59	UR16-T254	Volume (Rear) Attach to R1A.
C	Switch	½				KB-3	US-37	Attach to R1B.
R2A	50KΩ	½	40X361	QU1-128	A47-50K-S	AB-31	U-35	Horizontal Hold
B	Shaft	½	Not Req.	NQ	R3-3/16	AK-4	Not Req.	Attach to R2B.
R3A	1. 5Meg	½	40X334	QU1-138	A47-1. 5Meg-S	AB-75	U-155	Tone
B	Shaft	½	Not Req.	NQ	R3-3/16	AK-4	Not Req.	Attach to R3B.
R4A	500KΩ	½	40X333	QU1-133	A47-500K-S	AB-59	U-50	Brightness
B	Shaft	½	Not Req.	NQ	R3-3/16	AK-4	Not Req.	Attach to R4B.
R5A	1. 5Meg	½	40X334	QU1-138	A47-1. 5Meg-S	AB-60	U-155	Vertical Hold
B	Shaft	½	Not Req.	NQ	R3-3/16	AK-4	Not Req.	Attach to R5B.
R6A	2. 5Meg	½	40X369	QU1-139	A47-2. 5Meg-S	AB-83	TA355L	AGC
B	Shaft	½	Not Req.	RQ	FK3-1/4	AK-1	Not Req.	Attach to R6B
R7A	2. 5Meg	½	40X369	QU1-139	A47-2. 5Meg-S	AB-83	TA2551.	Height
B	Shaft	½	Not Req.	RQ	FK3-1/4	AK-1	Not Req.	Attach to R7B.
R8A	10000Ω	½	40X375	QU1-116	A47-10K-S	AB-16	TA141.	Vertical Linearity
B	Shaft	½	Not Req.	RQ	FK2-1/4	AK-1	Not Req.	Attach to R8B.
R9A	7. 5Meg	½	40X370	QU1-142	A47-7. 5Meg-S	AB-89	U-82	Sync Stability
B	Shaft	½	Not Req.	RQ	FK2-1/4	AK-4	Not Req.	Attach to R9B.

◆CONCENTRIKIT EQUIVALENT: K-4 KIT, BASE ELEMENTS AND SHAFTS, B11-1B3, P6-2[illegible] (Panel)
B13-137X, R16-313 (Resr)
T6-2 (Switch)

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA FIRESTONE PART No.	IRC PART No.	NOTES
R10	100Ω	½	12TA2100K	BTS-100	
R11	10KΩ	½	12TA2103K	BTS-10K	
R12	1000Ω	½	12TA2102K	BTS-1000	
R13	22KΩ	½	12TA2223K	BTS-22K	
R14	47KΩ	½	12TA2473M	BTS-47K	
R15	270KΩ	½	BR4374	BTS-270K	
R16	180KΩ	½	BR4184	BTS-180K	
R17	680Ω	½	12TA2681K	BTS-680	
R18	6800Ω	½	12TA2682K	BTS-6800	
R19	100KΩ	½	12TA2104K	BTS-100K	
R20	100KΩ	½	12TA2104K	BTS-100K	
R21	10KΩ	½	12TA2103M	BTS-10K	
R22	3300Ω	½	12SA2332K	BTA-3300	
R23	100KΩ	½	12TA2104K	BTS-100K	
R24	8200Ω	½	12TA2822K	BTS-8200	
R25	33KΩ	½	12TA2333M	BTS-33K	
R26	3300Ω 5%	½	B3333		

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA FIRESTONE PART No.	IRC PART No.	NOTES
R27	470Ω	½	B3471	BTS-470	
R28	470 5%	½	B3470	BTS-47 5%	
R29	1000Ω	½	B3502	BTS-1000	
R30	3300 5%	½	B3330		
R31	4700	½	B3471	BTS-470	
R32	470 5%	½	B3470	BTS-47 5%	
R33	150Ω	½	B3151	BTS-150	
R34	39K 5%	½	B3392		
R35	1500Ω	½	B3452	BTS-1500	
R36	1800	½	B3392	BTS-180	
R37	150Ω	½	B3151	BTS-150	
R38	100K	½	B3104	BTS-100K	
R39	330K 5%	½	B3334	BTS-330K 5%	
R40	39000 5%	½	B3393		
R41	5600Ω	½	C3562		
R42	150ΩG	½	B4453	BTS-1500	
R43	1Meg	½	B4105		

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS (cont)

ITEM No	RATING OHMS	RATING WATT	REPLACEMENT DATA FIRESTONE PART No	IRC PART No	NOTES
R44	680Ω	1	B3680	BTS-680	
R45	3000Ω	2	B3302	BTS-3000	
R46	3000Ω	2	B3302	BTS-3000	
R47	100KΩ	½	B4104		
R48	1Meg	½	B4105	BTS-2200	
R49	2200Ω	½	B4222		
R50	22KΩ	½	B4223		
R51	100KΩ	½	B4104		
R52	47KΩ	½	B4473		
R53	2. 7Meg	½	B4375	BTS-2. 7Meg	
R54	470KΩ	½	B4474	BTS-470K	
R55	47KΩ	½	B4473		
R56	33KΩ	½	B4333		
R57	100KΩ	½	B4104	BTS-1000	
R58	100Ω	½	B4101	BTS-100	
R59	56KΩ	½	B4563	BTS-56K	
R60	1000Ω	½	B3502	BTS-1000	
R61	33KΩ	½	B4333	BTS-33K	Note 1
R62	33KΩ	½	B4333	BTS-33K	
R63	10KΩ 5%	½	B3103	BTS-10K 5%	
R64	10KΩ 5%	½	B3103	BTS-10K 5%	
R65	27KΩ	½	B4273	BTS-270	
R66	68KΩ	½	B4683	BTS-68K	
R67	10Meg	½	B4106	BTS-10Meg	
R68	68KΩ	½	B4683	BTS-68K	
R69A	500KΩ	½	†7X25	BTS-470K	
B	500KΩ	½		BTS-470K	
R70	1000Ω	2	D4502	BTS-1000	
R71	330Ω	½	C4331	BTA-330	
R72	47KΩ	½	B4473		
R73	270KΩ	½	B4274		
R74	10KΩ	½	B4103		
R75	1. 5Meg	½	B4155		
R76	820KΩ	½	B4824		
R77	68KΩ	½	B4683		
R78	33000 5%	½	B3333		
R79	33000 5%	½	B3333		
R80A	22KΩ				
B	2200Ω		◆ †7X27		
C	8200Ω				

ITEM No	RATING OHMS	RATING WATT	REPLACEMENT DATA FIRESTONE PART No	IRC PART No	NOTES
R81	33KΩ	½	B4233		
R82	3. 3Meg 5%	½	B3335		
R83	22KΩ	½	B4223		
R84	2. 2Meg	½	B4225		
R85	200KΩ 5%	½	B4224		
R86	2. 2Meg	½	B4225		
R87	1. 8Meg	½	B04185		
R88	8200Ω	½	B84823		
R89	820Ω	½	B84821		
R90	560Ω	½			
R91	100KΩ	½	B84104		
R92	470KΩ	½	B85474		
R93	27KΩ	½	B84275		
R94	6800Ω	1	C84682		
R95	6800Ω	1	C84682		
R96	100KΩ	½	B84104		
R97	4. 7Meg	½	B85475		
R98	47000 5%	½	B83472		
R99	180KΩ	½	B84184		
R100	47KΩ	1	C84473		
R101	47KΩ	½	B84473		
R102	150KΩ	½	B83154		
R103	1500Ω	½	B83152		
R104	82000Ω	½	B84283		
R105	470KΩ	½	B85474		
R106	68Ω	½	B85680		
R107	33KΩ	2	D84233		
R108	27KΩ	2	D84273		
R109	100Ω	2	D84101		
R110	5600Ω	½	B84562		
R111	6800Ω	2	D84682		
R112	3. 3Ω	½	43X338	BTS-3. 3	
R113	1Meg	1	C85105	BTA-1Meg	
R114	1700Ω	10	43X268		
R115	230Ω	10	43X273		
R116	100KΩ	2	D85104	BTS-100K	
R117	270KΩ	½	B85274	BTS-270K	

Note 1. In some versions, a 100K ½W resistor is used in this application.
† Items C64A, C64B, C64C, R65A, R65B are combined in one unit.
◆ Items C68A, C68B, C68C, R80A, R80B, R80C are combined in one unit.

TRANSFORMER (POWER)

ITEM No	RATING PRI.	RATING SEC. 1	RATING SEC. 2	REPLACEMENT DATA FIRESTONE PART No.	Halldorson PART No.	Merit PART No.	RCA TYPE No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ L 74A	500VCT @ 5VAC @ 3A		53X339A	P9715 ④	P-2836 ⑤		P-8333 ⑦		P-65B8 ⑦
		SEC. 3	SEC. 4 SEC. 5							
		6. 3VAC @ 9. 5A								

① Parallel and phase 6. 3V ③ 5. 5A windings for Sec. 3. Tape 6. 3V ③ 3. 3A, and 6. 3V ③ . 85A windings.
② Tape small 6. 3V winding.
③ Parallel and phase 6. 3V ③ 8A and . 5A windings for Sec. 3.
④ Use 5V taps on Sec. 1. Tape other taps, parallel and phase 6. 3V windings for Sec. 3.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No	USE	FIRESTONE PART No.	Halldorson PART No.	Merit PART No.	RCA TYPE No.	Rem PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T2	Vert. Osc. Trans.	54X110	B6702	A-3003	209271 ①	V405	A-8125	26A03	A-97X
T3	Horiz. Output Trans.	53X330 ② 53X346 ③	B7040 *	HVO-41 *	23227A ② 23227B ③	X110	A-8264 & WC-82 ①	F1Y-37 *	D-354 ④
T4	Vert. Output Trans.	52X185	X1806 ①	A-3039 ①	129271 ①	V313 ①	A-8141 ①	26B54 ①	WC-18① * A-104① ①
T5A	Yoke-Horiz. (53MH)	8A2334-4	DJ9622 ②	MDF-72 ②	31H38 ②	YTDF38 ②	DY-8A ②	Y-4 ④	Y-11 ④
B	Vert. (44MH)								
T6	Horiz. Lin. Coil (1. 2-5. 6MH)	8A2262	RF800 ②①	MWC-6 ①	31H1	20IR15	WC-8	WC-22	WC-18①
T7	Width Coil (. 1-. 6MH)	8A2183			20IR4 ①	20IR4	WC-4 ⑦	WC-15 ⑦	

① Drill new mounting hole(s).
② Used in models 13-G-177, 180, 181, (code number 334-4-A1M50B)
③ Used in models 13-G-177, 180, 181, (code number 334-4-A1M55A).
④ Enlarge mounting hole.
⑤ Connect to terminals #3 and #4.
⑥ Connect to coded blue and green centertaps.
⑦ Drill new mounting hole or use original bracket, slider and core.

* HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

	ORIGINAL TERMINAL CONNECTIONS	Halldorson Replacement Connections	Merit Replacement Connections	RCA Replacement Connections	Rem Replacement Connections	Stancor Replacement Connections	Thordarson Replacement Connections	Triad Replacement Connections
	6	13	13	10	13	13	13	10
	5	Jumper #10 & #11	Jumper #10 & #11	8	Jumper #10 & #11	Jumper #10 & #11	Jumper #10 & #11	8
	4	6	6	7	6	6	6	7
	3	4	4	See Note ⑧ 4	4	4	4	See Note ⑧ 4
	2	3	2	NC	2	3	2	NC
	1	1	1	3	1	1	1	3
	A	9	9	2	9	9	9	2
	G	8	8	1	8	8	8	1
Connect Width Coil Across		1 & 2	1 & 2	11ZR1 Across #1 & #2	1 & 2	1 & 2	1 & 2	WC-12 (Red & Blue terms) across #1 & #2
Special Notes			⑧					⑧

⑧ No connection to transformer, connect a damping capacitor (approximately 47-68MMF ⑨ 2KV) in series with R110 across horizontal yoke terminals #3 and #7.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA FIRESTONE PART No	Halldorson PART No	Merit PART No	Stancor PART No	Thordarson PART No	Triad PART No	NOTES
T8	5. 1KΩ	3. 6Ω	51X166B	Z1107	A-2930	A-3877	24S51	S-3X	

SPEAKER

ITEM No.	RATINGS SIZE	RATINGS FIELD	RATINGS V. C. IMP	REPLACEMENT DATA FIRESTONE PART No	QUAM PART No	NOTES
SP1	6"	PM	3. 5Ω	12AS16	6A1	① Alternate PM Speakers.
	8"	PM	3. 5Ω	12AS18 ①	8A21	
	10"	PM	3. 5Ω	12AS19 ①	10A31	

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA FIRESTONE PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	UHF Ant. Coil	0Ω						
L2	UHF Ant. Coil	0Ω						
L2A	UHF Ant., Mixer, Osc. Coils	0Ω		8A2331-10				Channels 10 thru 19
B	UHF Ant., Mixer, Osc. Coils	0Ω		8A2331-20				Channels 20 thru 29
C	UHF Ant., Mixer, Osc. Coils	0Ω		8A2331-30				Channels 30 thru 39
D	UHF Ant., Mixer, Osc. Coils	0Ω		8A2331-40				Channels 40 thru 49
E	UHF Ant., Mixer, Osc. Coils	0Ω		8A2331-50				Channels 50 thru 59
F	UHF Ant., Mixer, Osc. Coils	0Ω		8A2331-60				Channels 60 thru 69
G	UHF Ant., Mixer, Osc. Coils	0Ω		8A2331-70				Channel 70 thru 79
H	UHF Ant., Mixer, Osc. Coils	0Ω		8A2331-80				Channel 80 thru 82
L4A	FIL. Choke	0Ω						
B	FIL. Choke	0Ω		31K-157-07				
L5	Cathode Choke	0Ω		31K-157-02				
L6	RF Choke	0Ω						
L7	UHF Coupling	0Ω						
L8	RF Choke	0Ω						
L8A	VHF Ant. Coil	0Ω	0Ω	8A2329-2				Channel 2
B	VHF Ant. Coil	0Ω	0Ω	8A2329-3				Channel 3
C	VHF Ant. Coil	0Ω	0Ω	8A2329-4				Channel 4
D	VHF Ant. Coil	0Ω	0Ω	8A2329-5				Channel 5
E	VHF Ant. Coil	0Ω	0Ω	8A2329-6				Channel 6
F	VHF Ant. Coil	0Ω	0Ω	8A2329-7				Channel 7
G	VHF Ant. Coil	0Ω	0Ω	8A2329-8				Channel 8
H	VHF Ant. Coil	0Ω	0Ω	8A2329-9				Channel 9
I	VHF Ant. Coil	0Ω	0Ω	8A2329-10				Channel 10
J	VHF Ant. Coil	0Ω	0Ω	8A2329-11				Channel 11
K	VHF Ant. Coil	0Ω	0Ω	8A2329-12				Channel 12
L	VHF Ant. Coil	0Ω	0Ω	8A2329-13				Channel 13
L10	Neut. Coil	0Ω						
L11A	VHF RF, Mixer Grid, Osc. Coil	0Ω		8A2330-2				Channel 2
B	VHF RF, Mixer Grid, Osc. Coil	0Ω		8A2330-3				Channel 3
C	VHF RF, Mixer Grid, Osc. Coil	0Ω		8A2330-4				Channel 4

TIONS (Continued)

ont)

RATING OHMS	RATING WATT	REPLACEMENT DATA FIRESTONE PART No.	REPLACEMENT DATA IRC PART No.	NOTES
22KΩ	½	B84223		
3. 3Meg5%	½	B83335		
22KΩ	½	B84223		
2. 2Meg	½	B84225		
200KΩ5%	½	B84224		
2. 2Meg	½	B84225		
1. 8Meg	½	B84185		
8200Ω	½	B84822		
820Ω	½	B84821		
560Ω	½			
100KΩ	½	B84104		
470KΩ	½	B85474		
27KΩ	½	B84273		
6800Ω	1	C84682		
6800Ω	1	C84682		
100KΩ	½	B84104		
4. 7Meg	½	B85475		
4700Ω 5%	½	B83472		
180KΩ	½	B84184		
47KΩ	1	C84473		
47KΩ	½	B84473		
150KΩ	½	B83154		
1500Ω	½	B83152		
8200Ω	½	B84822		
470KΩ	½	B84474		
68Ω	½	B85680		
33KΩ	2	D84333		
27KΩ	2	D84273		
100Ω	2	D84101		
5600Ω	½	B84562		
6800Ω	2	D84682		
3. 3Ω	½	43X238	BTS-3. 3	
1Meg	1	C85105	BTA-1Meg	
1700Ω	10	43X286		
330Ω	10	43X273		
100KΩ	2	D85104	BTB-100K	
270KΩ	½	B85274	BTS-270K	

stor is used in this application.
are combined in one unit.
, R80C are combined in one unit.

OWER)

PLACEMENT DATA				
rit No.	RCA TYPE No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
38 ①		P-8333②		P-49BS③

③ 3. 3A, and 6. 3V ⑧ . 85A windings.

windings for Sec. 3.

CIRCUITS)

CEMENT DATA				
A No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
. ①	V405	A-8125	26A03	A-97X
& ①	X110	A-8264 & WC-5① *	FLY-37 *	D-354 & WC-12①*
① ②	V312 ① Y7DF14 ②	A-8141 ① DY-9A ②	26S54 ① Y-4 ②	A-104X ① Y-17 ②
	20IR15	WC-8	WC-22	WC-12⑥
⑦	20IR4	WC-4⑦	WC-15 ⑦	

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

	ORIGINAL TERMINAL CONNECTIONS	Halldorson Replacement Connections	Merit Replacement Connections	RCA Replacement Connections	Ram Replacement Connections	Stancor Replacement Connections	Thordarson Replacement Connections	Triad Replacement Connections
	6	13	13	10	13	13	13	10
	5	Jumper #10 & #11	Jumper #10 & #11	8	Jumper #10 & #11	Jumper #10 & #11	Jumper #10 & #11	8
	4	6	6	7	6	6.	6	7
	3	4	4	See Note ⑧	4	4	4	See Note ⑧
	2	2	2	NC	2	2	2	NC
	1	1	1	3	1	1	1	3
	A	9	9	2	9	9	9	2
	G	8	8	1	8	8	8	1
Connect Width Coil Across →	1 & 2	1 & 2	1 & 2	212R1 Across #1 & #2	1 & 2	1 & 2	1 & 2	WC-12 (Red & Blue terms)across #1 & #2
Special Notes →				⑧				⑧

⑧ No connection to transformer, connect a damping capacitor (approximately 47-68MMF ⑧ 2KV) in series with R110 across horizontal yoke terminals #3 and #7.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA FIRESTONE PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T8	5. 1KΩ	3.5Ω	51X166B	Z1107	A-2930	A-3877	24S51	S-3X	

SPEAKER

ITEM No.	RATINGS SIZE	FIELD	V. C. IMP.	REPLACEMENT DATA FIRESTONE PART No.	QUAM PART No.	NOTES
SP1	6"	PM	3. 5Ω	12A516	6A1	① Alternate PM Speakers.
	8"	PM	3. 5Ω	12A518 ①	8A21	
	10"	PM	3. 5Ω	12A519 ①	10A31	

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA FIRESTONE PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	UHF Ant. Coil	0Ω						
L2	UHF Ant. Coil	0Ω						
L3A	UHF Ant., Mixer, Osc. Coils	0Ω		9A2331-10				Channels 10 thru 19
B	UHF Ant., Mixer, Osc. Coils	0Ω		9A2331-20				Channels 20 thru 29
C	UHF Ant., Mixer, Osc. Coils	0Ω		9A2331-30				Channels 30 thru 39
D	UHF Ant., Mixer, Osc. Coils	0Ω		9A2331-40				Channels 40 thru 49
E	UHF Ant., Mixer, Osc. Coils	0Ω		9A2331-50				Channels 50 thru 59
F	UHF Ant., Mixer, Osc. Coils	0Ω		9A2331-60				Channels 60 thru 69
G	UHF Ant., Mixer, Osc. Coils	0Ω		9A2331-70				Channel 70 thru 79
H	UHF Ant., Mixer, Osc. Coils	0Ω		9A2331-80				Channel 80 thru 82
L4A	Fil. Choke	0Ω						
B	Fil. Choke	0Ω		31K-137-07				
L5	Cathode Choke	0Ω		31K-137-02				
L6	RF Choke	0Ω						
L7	UHF Coupling	0Ω						
L8	RF Choke	0Ω						
L9A	VHF Ant. Coil	0Ω	0Ω	9A2329-2				Channel 2
B	VHF Ant. Coil	0Ω	0Ω	9A2329-3				Channel 3
C	VHF Ant. Coil	0Ω	0Ω	9A2329-4				Channel 4
D	VHF Ant. Coil	0Ω	0Ω	9A2329-5				Channel 5
E	VHF Ant. Coil	0Ω	0Ω	9A2329-6				Channel 6
F	VHF Ant. Coil	0Ω	0Ω	9A2329-7				Channel 7
G	VHF Ant. Coil	0Ω	0Ω	9A2329-8				Channel 8
H	VHF Ant. Coil	0Ω	0Ω	9A2329-9				Channel 9
I	VHF Ant. Coil	0Ω	0Ω	9A2329-10				Channel 10
J	VHF Ant. Coil	0Ω	0Ω	9A2329-11				Channel 11
K	VHF Ant. Coil	0Ω	0Ω	9A2329-12				Channel 12
L	VHF Ant. Coil	0Ω	0Ω	9A2329-13				Channel 13
L10	Neut. Coil	0Ω						
L11A	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-2				Channel 2
B	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-3				Channel 3
C	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-4				Channel 4

FIRESTONE
MODEL 13-G-183 (Code 280-5-21T26)

PARTS LIST AND DESCRIPTIONS (Continued)

COILS (cont)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA FIRESTONE PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
D	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-5				Channel 5
E	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-6				Channel 6
F	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-7				Channel 7
G	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-8				Channel 8
H	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-9				Channel 9
I	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-10				Channel 10
J	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-11				Channel 11
K	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-12				Channel 12
L	VHF RF, Mixer Grid, Osc. Coil	0Ω		9A2330-13				Channel 13
L12	UHF IF Coil	.2Ω						
L13	UHF IF Coil	.1Ω	.3Ω					
L14	UHF IF Coil	.1Ω	.3Ω					
L15	Fil. Choke	0Ω		34A-575				
L16	Conv. Plate	.1Ω		31K-264				
L17	IF Trap	.1Ω		9A2320				
L18	1st. Video IF	.1Ω		9A2316				
L19	2nd. Video IF	.2Ω	.2Ω	9A2317		TV-128	6218	Includes 47.25MC trap
L20	3rd. Video IF	.2Ω	.2Ω	9A2318	17-5003 *	TV-128 *	6233 *	
L21	Fil. Choke	0Ω		9A2033	19-1002		4606	2.2 Microhenries
L22	Parasitic Suppressor	0Ω		9A2322				1 turn heavy wire wound on 10Ω resistor
L23	Cathode Trap	0Ω	0Ω	9A2321				
L24	4th. Video IF	.5Ω	.5Ω	9A2319	17-5004	TV-125	6234	
L25	Fil. Choke	0Ω		9A2033	19-1002		4606	2.2 Microhenries
L26	Series Peaking Coil	7Ω		36A10	19-4060		6172 ■	60 Microhenries, wound on 22KΩ resistor
L27	Shunt Peaking Coil	18Ω		36A22	19-3300	TV-185	6155	290 Microhenries
L28	4.5MC Trap	.3Ω		9A2074	20-1004	TV-151	1470	
L29	Shunt Peaking Coil	9.5Ω		36A1	19-3100	TV-181	6177	100 Microhenries
L30	Shunt Peaking Coil	10Ω		36A25	19-3100 ▲	TV-181 ▲	6177 ▲	100 Microhenries, wound on 470Ω resistor
L31	Series Peaking Coil	12.5Ω		36A12	19-4160	TV-184 ■	6180 ■	160 Microhenries, wound on 22KΩ resistor
L32	Shunt Peaking Coil	13.5Ω		36A2	19-3180	TV-184	6154	190 Microhenries
L33	1st. Sound IF	2Ω		9A2201	17-1031 ♦	TV-113 ▲	6203 ▲	
L34	2nd. Sound IF	2.4Ω	2Ω	9A2323	17-3495	TV-113	6203	
L35	Ratio Det.	4.2Ω	.6ΩCT	9A2295	17-3497	TV-115	6205	Tertiary winding -.5Ω
L36	Horiz. Osc.	63Ω		9A2096	19-1576	TV-163	6210	

* Detune trap.
■ Parallel with 22KΩ resistor.
▲ Parallel with 470Ω resistor.
♦ Drill mounting holes.
▲ Use one winding.

FILTER CHOKE

ITEM No.	RATINGS TOTAL DIRECT CURRENT	RATINGS D. C. RESISTANCE	RATINGS INDUCTANCE (0 CURRENT 1000 ~)	REPLACEMENT DATA FIRESTONE PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
L37	.240ADC	39.6Ω	1.06HY	52X96	C-5037 ①	C-2996 ①	C-2326 ①	26C44	C-23X ①

① Drill one new mounting hole.

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA FIRESTONE PART No. FUSE	FIRESTONE PART No. HOLDER	LITTELFUSE PART No. FUSE	LITTELFUSE PART No. HOLDER	BUSS PART No. FUSE	BUSS PART No. HOLDER
M1	3AG S/B	4/10A 125V	16X147-3	16X146	313.400 (3AG S/B 410A)	357001	MDL 4/10	4405

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA FIRESTONE PART No.	REPLACEMENT DATA SYLVANIA PART No.	NOTES
M2	1N82A*	31K-111	1N82 or 1N82A	UHF Mixer

*Some versions may use type 1N82 crystal diode in this application.

PARTS LIST AND DESCRIPTIONS (Continued)

MISCELLANEOUS

ITEM No.	PART NAME	FIRESTONE PART No.	NOTES
M3	Dial Light	7A32	#51
M4	Tuner	25A1124	VHF-UHF combination
	Tuner	25A1128	VHF-UHF combination
M5	Trap	31K-225-03	VHF Ant. Input Filter
M6	Focus Magnet	2A438-2	Includes centering device
M7	Ion Trap	2A421	
	Contact Board Assy.	31K-213	Tuner - Includes L12, L13, L14
B2	Trimmer Cap.	17A269	Horiz. Drive (120-400MMF)
	Knob	10A851-1	UHF Channel - Maroon (Code 334-4-AM50A, B)
	Knob	10A849-1	VHF Channel - Maroon (Code 334-4-AM50A, B)
	Knob	10A831-1	Contrast - Maroon (Code 334-4-AM50A, B)
	Knob	10A830-1	On-off-volume - Maroon (Code 334-4-AM50A, B)
	Knob	10A851-2	UHF Channel - Beige (Code 334-4-AM50A, B)
	Knob	10A849-2	VHF Channel - Beige (Code 334-4-AM50A, B)
	Knob	10A831-2	Contrast - Beige (Code 334-4-AM50A, B)
	Knob	10A830-2	On-off-volume - Beige (Code 334-4-AM50A, B)
	Knob	10A846-1	Fine tuning - Maroon (Model 13-G-177, 13-G-180)
	Knob	10A853-1	UHF Channel Selector - Maroon (Models 13-G-177, 13-G-180)
	Knob	10A852-1	VHF Channel Selector - Maroon (Models 13-G-177, 13-G-180)
	Knob	10A847-1	Contrast - Maroon (Models 13-G-177, 13-G-180)
	Knob	10A846-2	Fine tuning -Model 13-G-181 (Code AM55A)
	Knob	10A853-2	UHF Channel Selector - Model 13-G-181 (Code AM55A)
	Knob	10A852-2	VHF Channel Selector - Model 13-G-181 (Code AM55A)
	Knob	10A847-2	Contrast - Model 13-G-181 (Code AM55A)
	Knob	10A830-3	On-off-volume - Model 13-G-181 (Code AM55A)
	Lever Arm	37X343	Fine tuning (Code 334-4-AM50A, B)
	Spring	28X611	Lever Arm (Code 334-4-AM50A, B)
	Safety Glass	17X180	(Code 334-4-AM50A, B)
	Safety Glass	17X189	(Code 334-4-AM55A)
	Mask	4X1230-1	(Code 334-4-AM50A, B)
	Mask	4X1241-4	(Code 334-4-AM55A)

PROPERTY OF
L. F. BLANKENSHIP
3914 MEADE ST.
DENVER, COLORADO

PROPERTY OF
L. F. BLANKENSHIP

TROUBLE SHOOTING AIDS (cont)

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V19, V20, V21 and V22. Check waveform W18.

If Satisfactory	If Unsatisfactory
Check T3, T5A, T6, T7, R107, R108, C87, C88, C89, C90 and other associated components.	Check L36, C83, C84, R98, R99, R102, R103 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V20, V21 and V23. Check adjustments B2, B3 and B4. Check T3, T5A, R107, R108, R99 and other associated components.

BLOOMING

Check by substitution V20, V21, V22 and V23. Check T3, T5A, R113, R108, R107, C90 and other associated components.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video."

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or no Sound."

RASTER, NO SOUND, NO PICTURE

Check by substitution V2, V3, V4, V5, V6, V7, V8 and V9. Check video IF components for failure or change of value. Raster, No Sound, No Picture, UHF, substitute V1.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set."

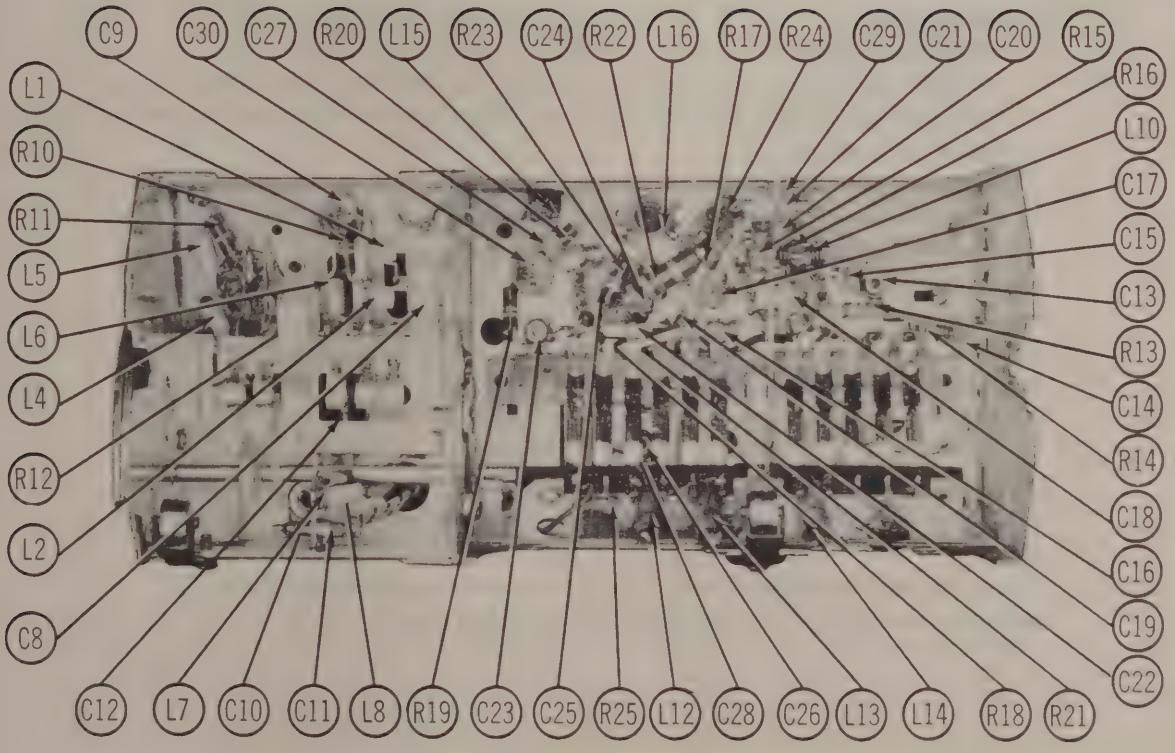
KEYSTONE EFFECT

Check T5 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



RF TUNER BOTTOM VIEW

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

Touch-up adjustment of the VHF tuner oscillator circuit may be accomplished as follows:

1. Set the selector knob to VHF position.
2. Tune in a TV station and set the fine tuning control to the center of its range.
3. Remove the channel selector and fine tuning knobs.
4. Adjustments are accessible one at a time thru the small hole above and slightly to the left of the channel switch shaft.

To adjust the UHF oscillator, set the channel selector knobs to the desired UHF channel. The fine tuning lever should be at the center of its range. Remove knobs and adjust the oscillator slug, thru the same hole as for VHF adjustments. If two UHF channels are received and use the same UHF coil strips, the oscillator should be set for the channel closest to the center of the group.

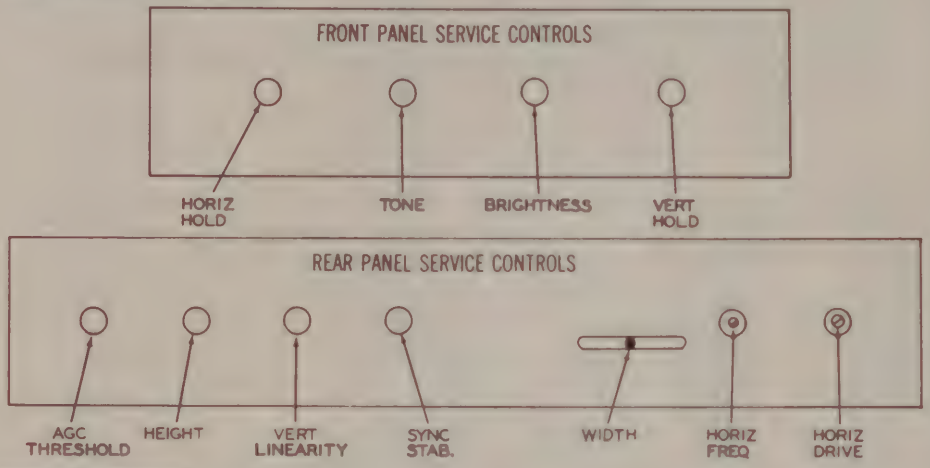
PICTURE TUBE SAFETY GLASS CLEANING

To clean safety glass, remove 5 wood screws holding plastic strip at the top of the safety glass. Remove plastic strip and safety glass. Use extreme caution when removing safety glass.

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION



SPECIAL ADJUSTMENTS

AGC THRESHOLD CONTROL

Tune in the strongest TV station available. Turn the AGC threshold control clockwise until a buzz in the sound and a washed out picture appears, then turn the control slightly counter clockwise for clearest picture and best sound.

SYNC STABILITY CONTROL

With the picture locked in slowly turn the sync stability control clockwise until bending occurs at top of picture. Turn control slightly counter clockwise until bending disappears. In general, the weaker the signal area the more clockwise the control should be turned.

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

Adjustment of the horizontal oscillator circuit can be made from the rear panel of the chassis. Set the horizontal hold control to its mid-range position and adjust the horizontal oscillator coil (L36) until picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the ratio detector secondary (L35) located on top of chassis. (See tube placement chart).

FUSES

One fuse is used for LV power supply protection. (For location see tube placement chart).

CENTERING

Centering is accomplished mechanically by means of a centering lever on the PM focusing assembly. Adjust the centering lever from side to side, and up and down until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

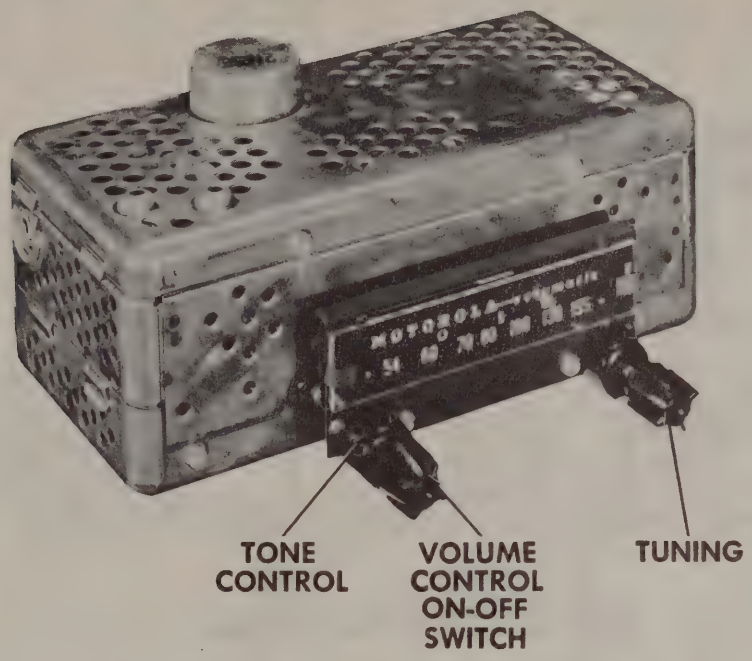
CHASSIS REMOVAL

1. Remove 4 push-on type control knobs and fine tuning lever from front panel of cabinet.
2. Remove 2 wood screws and 2 metal screws. Remove rear cover.
3. Loosen 4 wood screws. Remove 2 antenna bracket.
4. Remove speaker leads.
5. Remove 5 chassis bolts. Remove chassis.
6. Remove 4 speaker nuts. Remove speaker.

3924 MEADE ST.
DENVER, COLORADO

PROPERTY OF
L. F. BLANKENSHIP
3874 MEADE ST.
DENVER, COLORADO

MOTOROLA
MODELS 5M, 5M-12



MOTOROLA
MODELS 5M, 5M-12

TRADE NAME	Motorola Models 5M (6 Volt), 5M-12 (12 Volt)
MANUFACTURER	Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.
TYPE SET	Battery Operated Universal Automobile AM Superheterodyne Receiver
TUBES (Six)	Types 6BD6 RF Amp., 6BE6 Conv., 6BD6 IF Amp., 6CR6 Det.-AVC-AF Amp., 6AQ5 Output, 6X4 Rectifier (or) 12 Volts Equivalents
POWER SUPPLY	6 (or) 12 Volts Storage Battery
TUNING RANGE—BROADCAST	540KC-1600KC
RATINGS	5.6 Amp. @ 6.3Volts DC 3.1 Amp. @ 12.6 Volts DC

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.
To set pointer, turn tuning capacitor fully closed and set pointer to last reference mark at low frequency end of dial.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1.	.1MFD	High side to pin 7 (grid) of 6BE6 (V2). Low side to chassis.	455KC (400~Mod)	High freq. end stop	Across voice coil	A1, A2, A3, A4	Adjust for maximum output.
2.	Fig. 1	Thru dummy to antenna receptacle	1610KC	"	"	A5, A6, A7	Back tuner cores out of coils. Adjust A5, A6 and A7 in order given for maximum output.
3.	"	"	1400KC	Set tuner 13/64" from high freq. end stop	"	A8, A9, A10	Using alignment tool (Fig. 2), adjust in order given A8, A9 and A10 for maximum output. Repeat steps 2 and 3 with receiver installed, antenna fully extended, tune to weak signal around 1400KC. Adjust A7 for maximum volume.

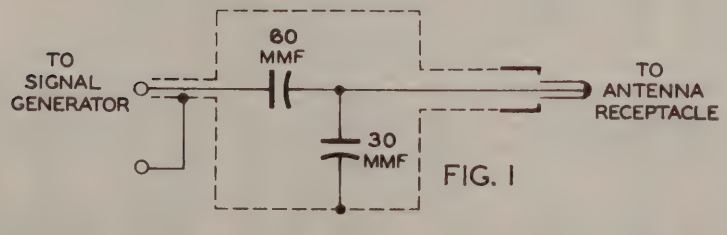


FIG. 1

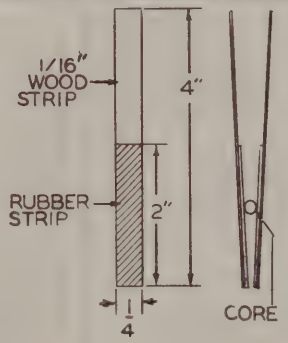


FIG. 2

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PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: MOTOROLA PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amplifier	6BD6	6BD6	7BK	Model 5M-12 uses 12BD6
V2	Converter	6BE6	6BE6	7CH	Model 5M-12 uses 12BE6
V3	IF Amplifier	6BD6	6BD6	7BK	Model 5M-12 uses 12BD6
V4	Det.-AVC-AF Amp.	6CR6	6CR6	7EA	Model 5M-12 uses 12CR6
V5	Output	6AQ5	6AQ5	7BZ	Model 5M-12 uses 12AQ5
V6	Rectifier	6X4	6X4	5BS	Model 5M-12 uses 12X4

ELECTROLYTIC CAPACITORS

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: MOTOROLA PART No.	REPLACEMENT DATA: MALLORY PART No.	REPLACEMENT DATA: PYRAMID PART No.	REPLACEMENT DATA: SANGAMO PART No.	NOTES
C1A	15	■350	23A485677	FP328	TM-3026	T-455	
B	10	▲350					
C	20	25					

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: MOTOROLA PART No.	REPLACEMENT DATA: CENTRALAB PART No.	REPLACEMENT DATA: ERIE PART No.	REPLACEMENT DATA: MALLORY PART No.	NOTES
C2	90		21K533453				
C3	.006	400	8R121001		GP2-333-602	PT626	
C4	5		21R115955	TCZ-4R7	NP0A-050	ZT-555	
C5	47		21R115593	TCN-47	N750K-470	NT-5447	
C6	.05	400	8R121567	DF-503		PT415	
C7	.05	200	8R121005	DF-503		PT415	
C8	10000		21R482726	DD-103	811-01	DC-511	
C9	.002	600	8K121568	D6-202	GP2-333-202	PT622	
C10	.02	200	8R121003	DF-203	817-02	PT412	
C11	.1	400	8R121006	DF-104		PT401	
C12	.01	400	8R121002	D6-103	GP3-333-103	PT411	
C13	470		21R410121	DD-471	811-471	UC-5347	
C14	.004	600	8R121000	D6-402	GP2-333-402	PT624	
C15A	300		21A522033				
B	300						
C16	.02	1000	8R121004			PT1612	Note
C17	.5	100	8K122076			RF480	
C18	.5	100	8K122076			RF480	

Note 1. Model 5M-12 uses a .04MFD capacitor (part #8A121549) in this application.

CONTROLS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	REPLACEMENT DATA: MOTOROLA PART No.	REPLACEMENT DATA: IRC PART No.	REPLACEMENT DATA: CLAROSTAT PART No.	REPLACEMENT DATA: CENTRALAB PART No.	REPLACEMENT DATA: MALLORY PART No.	INSTALLATION NOTES
R1A	1Meg	½	18K533457	QJ-800A ♦		F1-55		Tone - Panel
B	250KΩ	½				R4-37		Volume-Rear-tap @ 125KΩ
C	Switch					KB-4		Attach R1B

♦ CONCENTRIKIT EQUIVALENT: K-6 KIT, BASE ELEMENTS & SHAFTS: B11-137, P17-129 (Panel)
B13-130X, R9-214 (Rear)
76-1 SWITCH

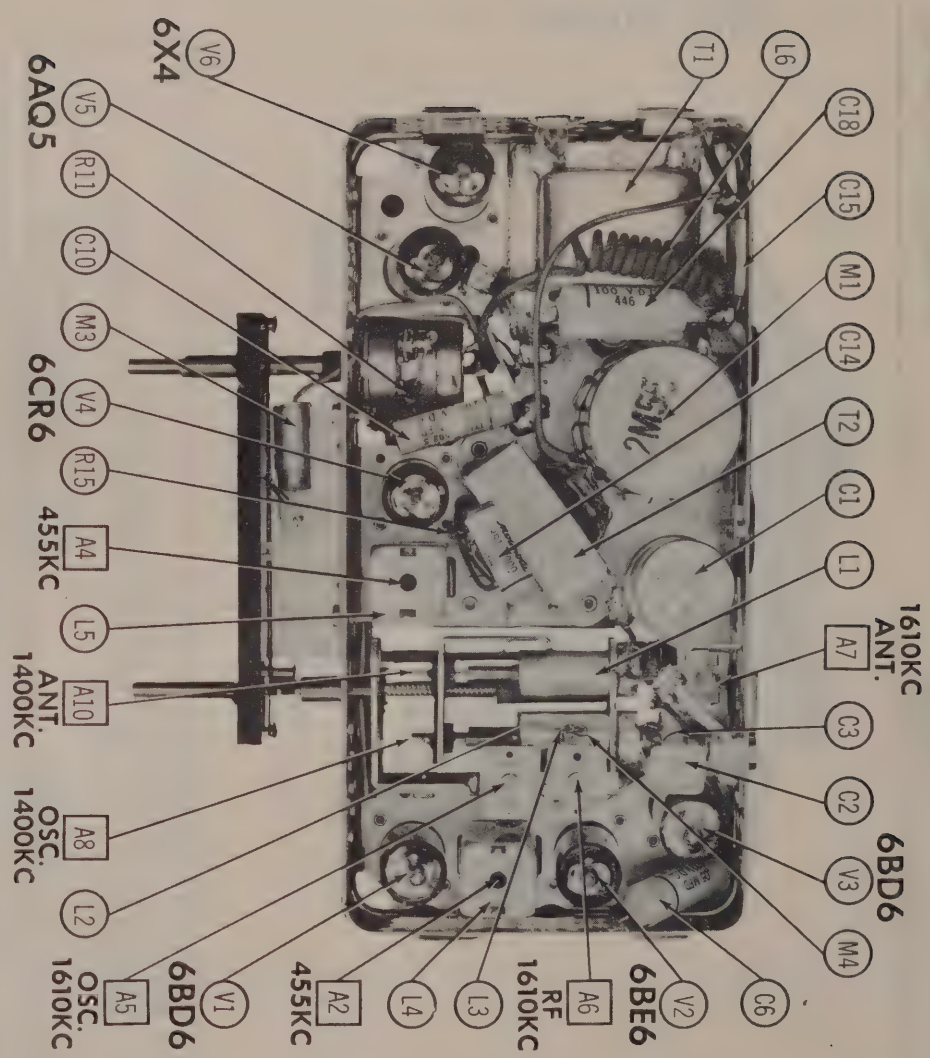
RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: MOTOROLA PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R2	1Meg	½	6R6004	BTS-1Meg	
R3	220Ω	½	6R6270	BTS-220	
R4	100KΩ	½	6R6075	BTS-100K	
R5	47KΩ	½	6R6056	BTS-47K	
R6	6800Ω	2	6R5690	BTB-6800	
R7	330Ω	½	6R6022	BTS-330	
R8	1Meg	½	6R6004	BTS-1Meg	
R9	2.2Meg	½	6R3927	BTS-2.2Meg	

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: MOTOROLA PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R10	1Meg	½	6R6004	BTS-1Meg	
R11	15KΩ	½	6R2119	BTS-15K	
R12	220KΩ	½	6R6015	BTS-220K	
R13	270KΩ	½	6R6414	BTS-270K	
R14	270Ω	½	6R6432	BTS-270	
R15	4.7Meg	½	6R2122	BTS-4.7Meg	
R16	2200Ω	2	6R476130	BTB-2200	
R17	56Ω	1	6R2037	BTA-56	Note 1
R18	56Ω	1	6R2037	BTA-56	Note 1

Note 1. Model 5M-12 uses a 220Ω, 1 watt resistor in this application (Mfgr part #6R6389).

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (VIBRATOR)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	MOTOROLA PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	6.3VCT @3A or 12VCT @1.8A	470VCT .042ADC or 470VCT .053ADC			25C501303-J ① 25C534978 ② 25C534979 ③					

① Used in Model 5M
② Alternate power transformer (Model 5M)
③ Used in Model 5M-12.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	MOTOROLA PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	5.2KΩ	3.5Ω	25B70171-P	Z1107	A-2930	A-3877	24S51	S-3X	

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA		NOTES
	SIZE	FIELD	V. C. IMP.	MOTOROLA PART No.	QUAM PART No.	
SP1	6" x 9"	PM	3.5Ω	50C533088 50C532887 ① 50C534058 ① 50C534059 ①	69A3	① Alternate 6" x 9" PM speakers

COILS (RF-IF)

ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	MOTOROLA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1	Ant. Coil	1Ω						Part of complete assy.
L2	RF Coil	1Ω						Part of complete assy.
L3	Osc. Coil	.6Ω	2.3Ω					Part of complete assy.
L4	Input IF	18Ω	18Ω	24C485553	16-6758	BC-352	12-C1	
L5	Output IF	18Ω	18Ω	24K485554	16-6770	BC-355	12-C6	
L6	Fil. Choke	0Ω		24K533822	19-4215		5221	1.1 Microhenries
L7	Vib. Hash Choke	0Ω		24A533673				17 Microhenries

VIBRATOR

ITEM No.	TYPE	INPUT VOLTS	FREQUENCY	REPLACEMENT DATA				NOTES
				MOTOROLA PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	RADIART PART No.	
M1	Interrupter	6.3V	115∿	48B3333	5342	903M	5342	Model 5M
	Interrupter	12V	115∿	48B522000	6326	G-859	6326	Model 5M-12

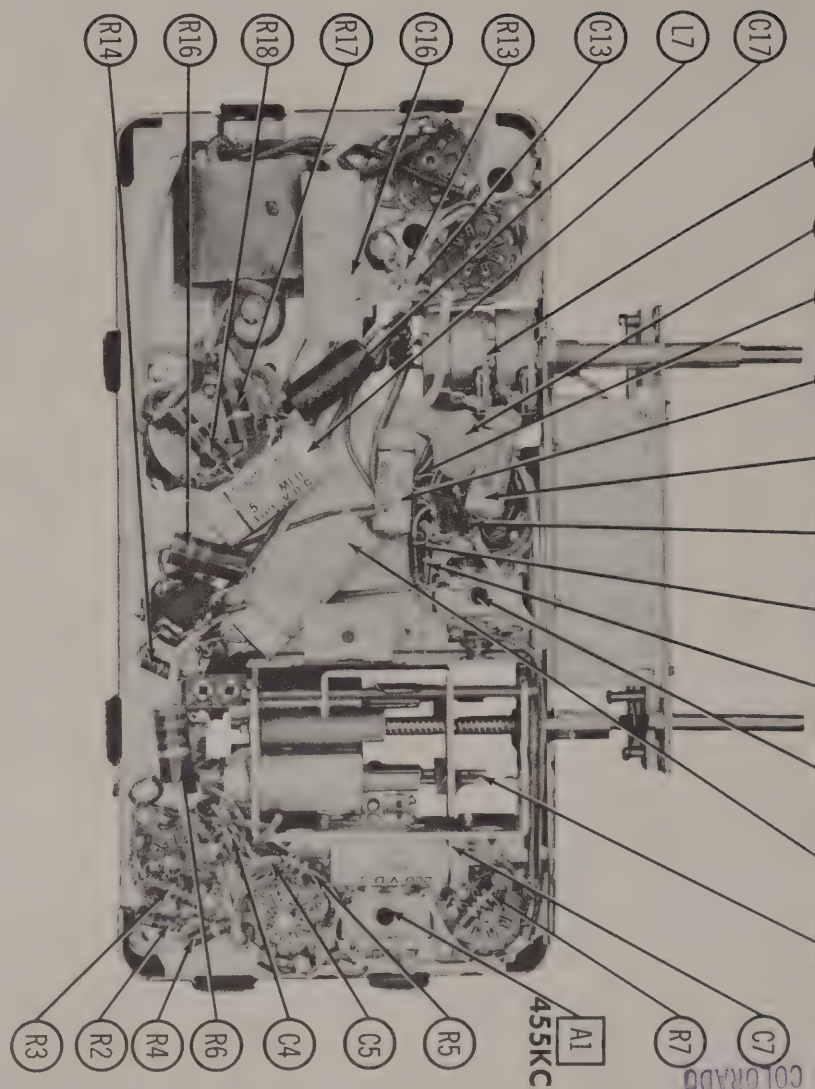
FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			MOTOROLA PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M2	SFE	9A	65X16248		307009 (SFE9A)	155009	SFE9	HRH

MISCELLANEOUS

ITEM No.	PART NAME	MOTOROLA PART No.	NOTES
M3	Dial Light	65X10867	#44 - Model 5M
M3	Dial Light	65T533821	#1891 - Model 5M-12
M4	Tuner	77K534238	Permeability - Not used in all versions
	Tuner	77D534479	Permeability - Used in some versions In tuner part #77D534479 the following coils have part numbers. L1 (Part #1K534998), L2 (Part #1K534997), L3 (Part #1K534999).
A5	Trimmer Cap.	20A485708	Osc. (430MMF Nom)
A6	Trimmer Cap.	20A481526	RF (70MMF Nom)
A7	Trimmer Cap.	20A502338	Ant. (80MMF Nom)
	Knob	36B355119	On-off-volume & tuning
	Knob	36K533121	Tone
	Knob	36B533120	Dummy
	Dial Scale	34B533980	
	Dial Pointer	1K532594	

CHASSIS—BOTTOM VIEW



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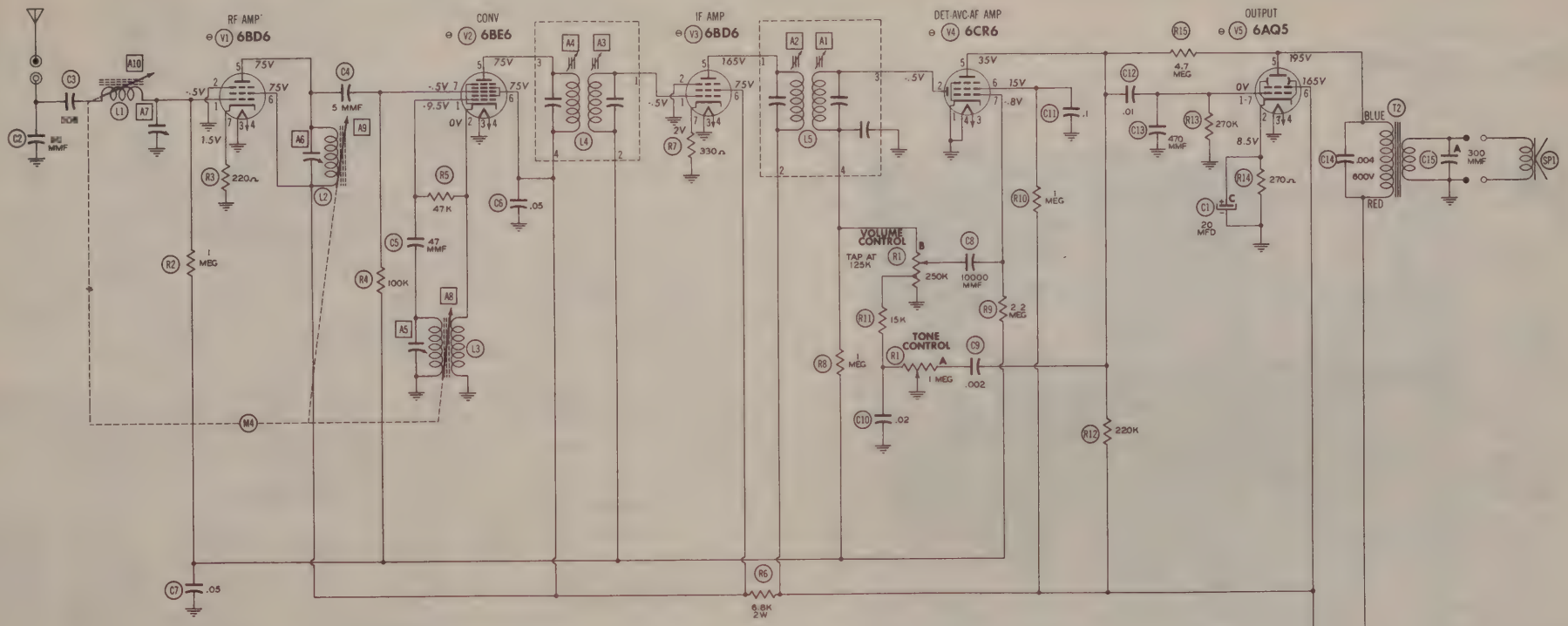

IF=455KC

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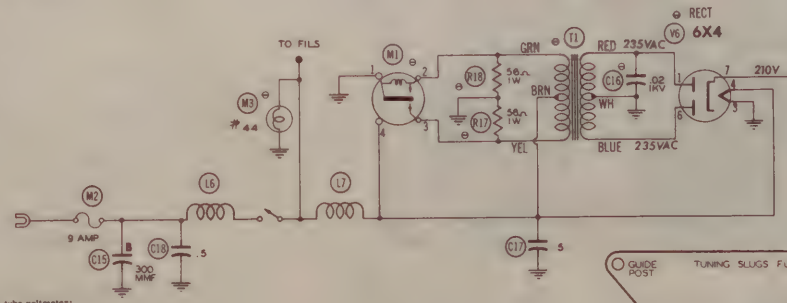
● SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

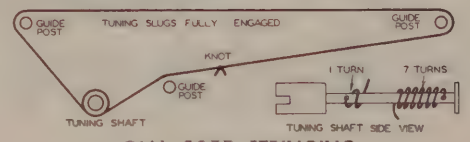


RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V 1	6BD6	2.2Meg	0Ω	0Ω	.4Ω	†9KΩ	†9KΩ	220Ω
V 2	6BE6	47KΩ	.5Ω	0Ω	.4Ω	†9KΩ	†9KΩ	1.3Meg
V 3	6BD6	1.2Meg	0Ω	0Ω	.4Ω	†2.2KΩ	†9KΩ	330Ω
V 4	6CR6	0Ω	250KΩ	.4Ω	0Ω	†222KΩ	†1Meg	3.4Meg
V 5	6AQ5	270KΩ	270Ω	0Ω	.4Ω	†350Ω	†2.2KΩ	270KΩ
V 6	6X4	320Ω	NC	0Ω	.4Ω	NC	320Ω	50KΩ

† MEASURED FROM PIN 7 OF V6.
NC - NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Battery voltage maintained at 6.3volts or 12.6 volts for voltage readings.
5. Nominal tolerance on components values makes possible a variation of ± 10% in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.



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MODEL 21T21E

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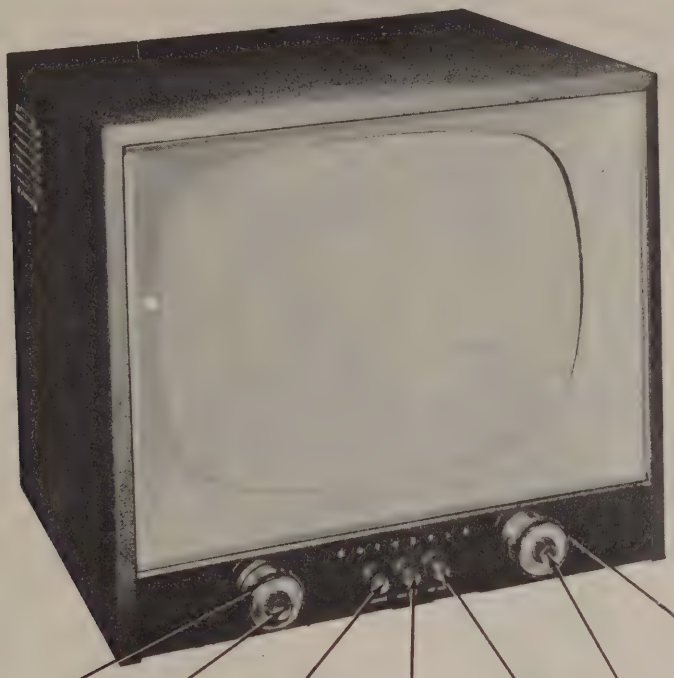

MOTOROLA MODEL 21T21E

TRADE NAME	Motorola	MODELS	CHASSIS	TUNERS
		21K30, 21K30B, 21K30W, 21T22, 21T22B	TS-531	TT-72 (VHF only)
		Y21K30, Y21K30B, Y21K30W, Y21T22, Y21T22B	TS-531Y	TT-72Y & TT-37 (VHF-UHF)
		21K29, 21K29B, 21K29W, 21K33E, 21T21, 21T21B, 21T21E	WTS-531	TT-72 (VHF only)
		Y21K29, Y21K29B, Y21K29W, Y21K33E, Y21T21, Y21T21B, Y21T21E	WTS-531Y	TT-72Y & TT-37 (VHF-UHF)

MANUFACTURER	Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Illinois
TYPE SET	Television Receiver
TUBES	Seventeen
POWER SUPPLY	110-120 Volts AC-60 Cycle RATING 1.13 Amp. @ 117 Volts AC
TUNING RANGE	Channels 2 thru 13 VHF, 14 thru 83 UHF, Video IF 45.75MC, Sound IF 41.25MC (Intercarrier)

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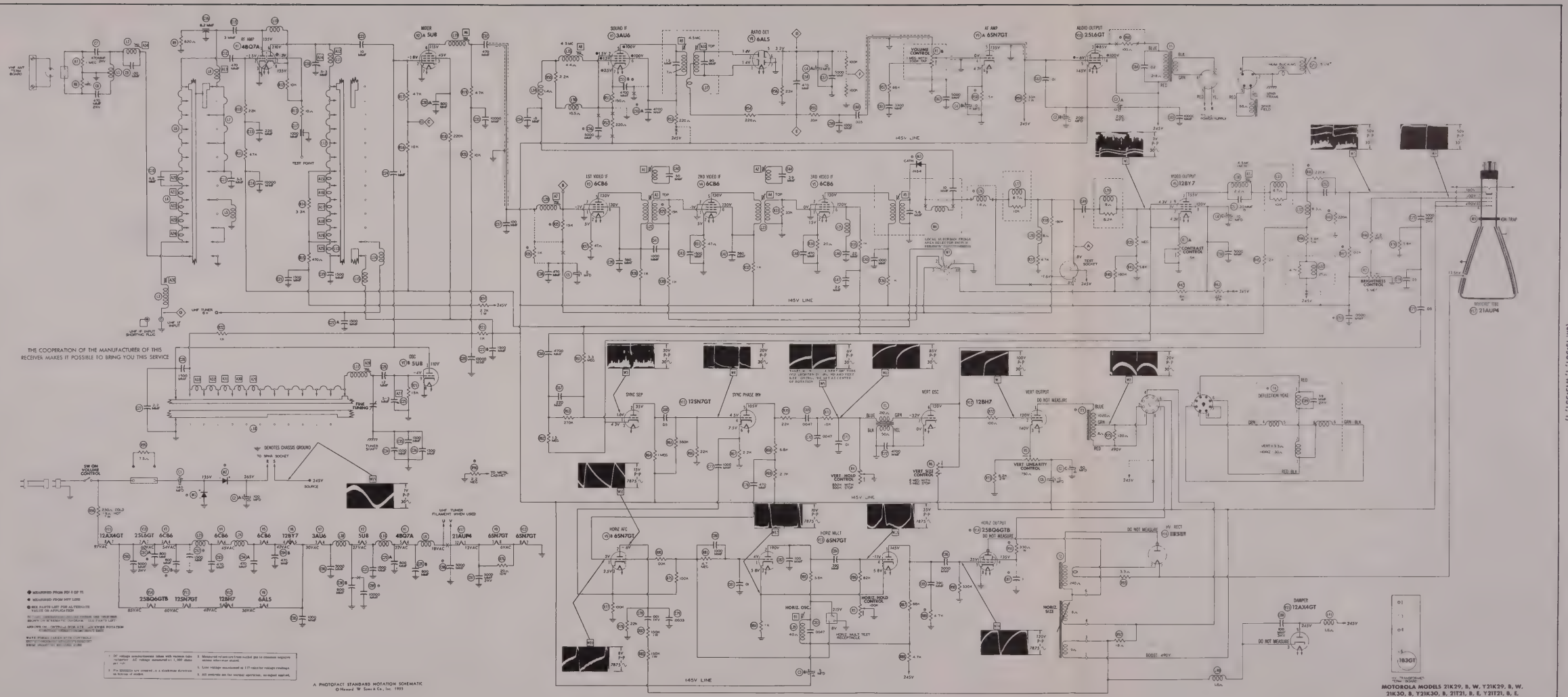
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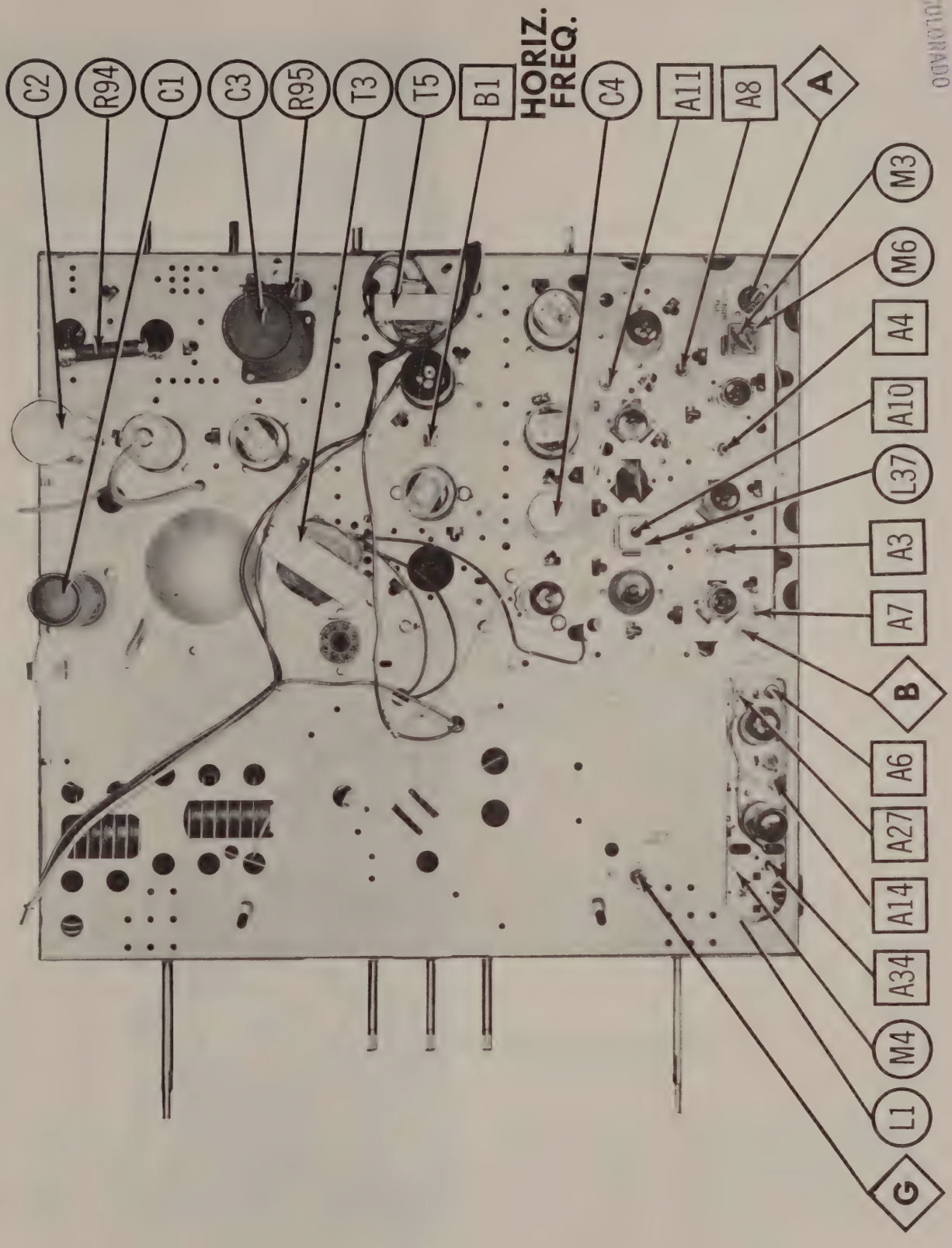

CHASSIS TOP VIEW

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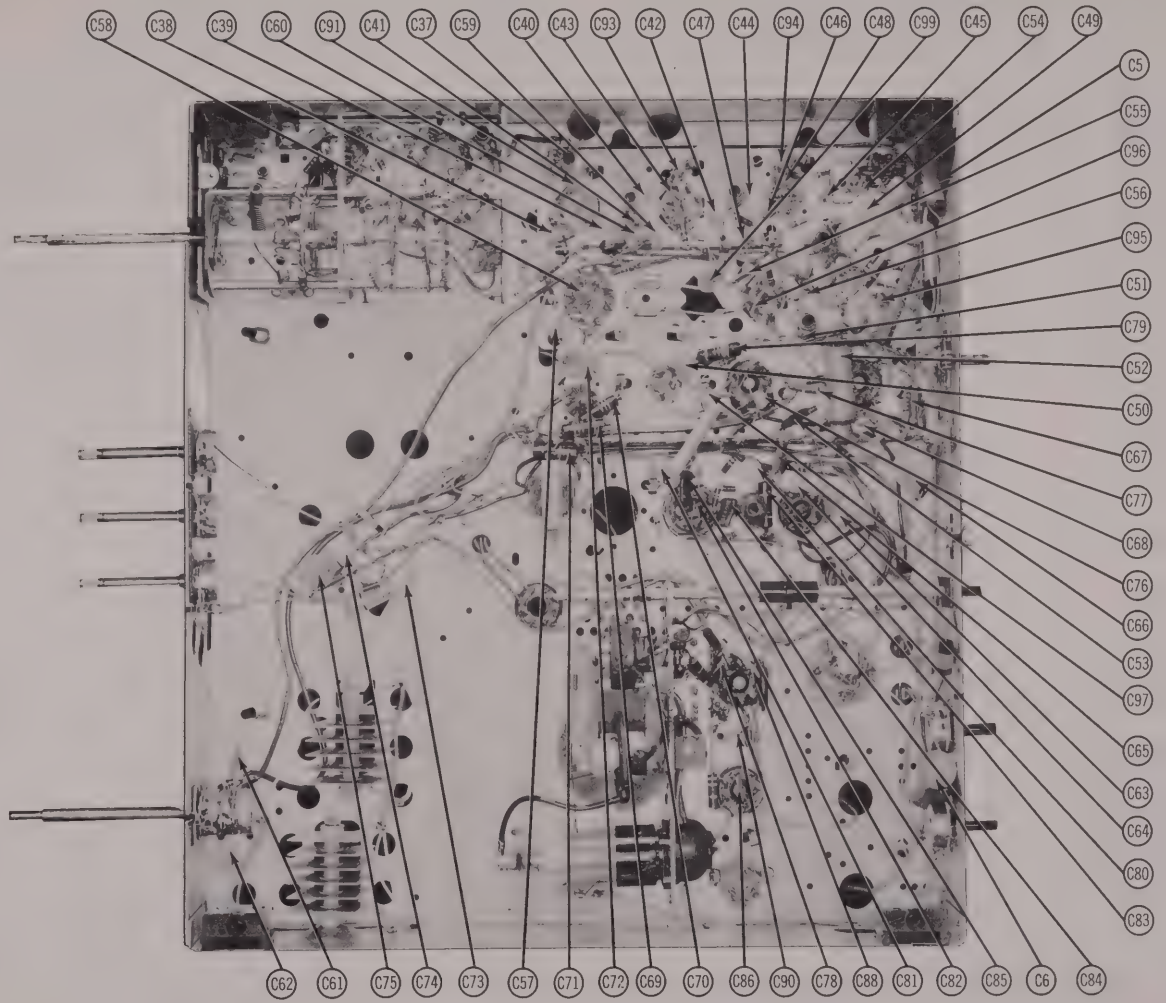
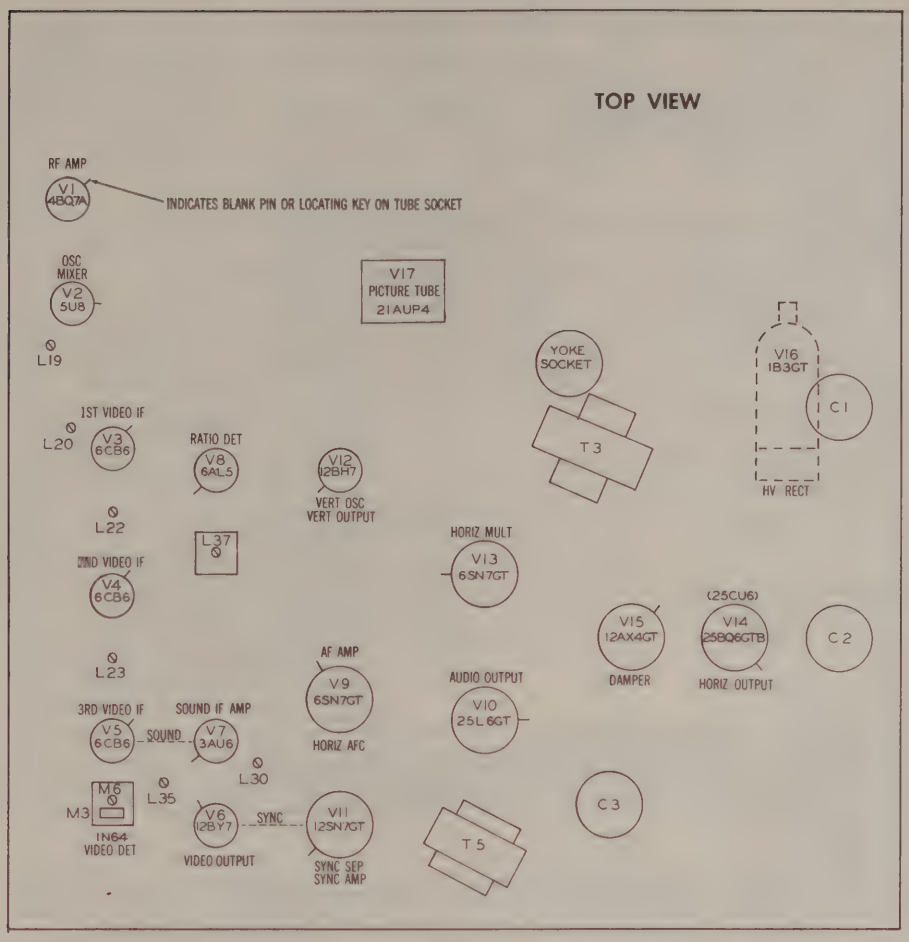


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

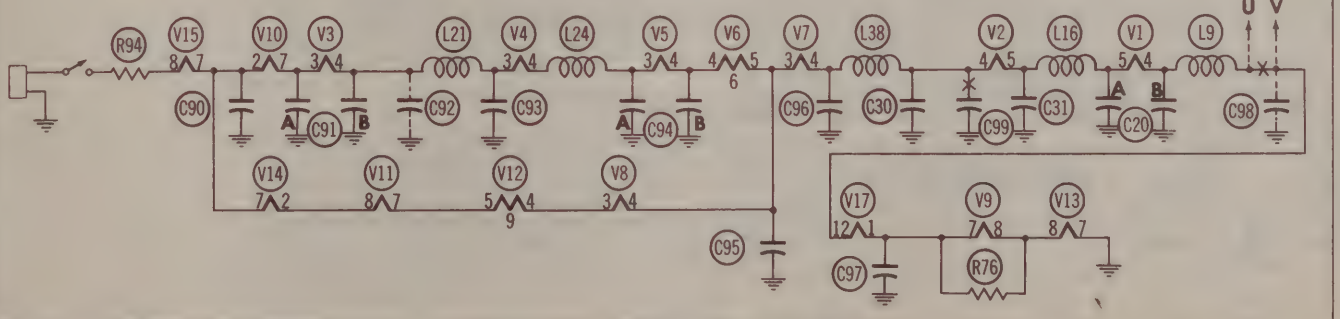
POWER SUPPLY FAILURE
No raster, no sound - Selenium Rectifiers (M1 & M2)

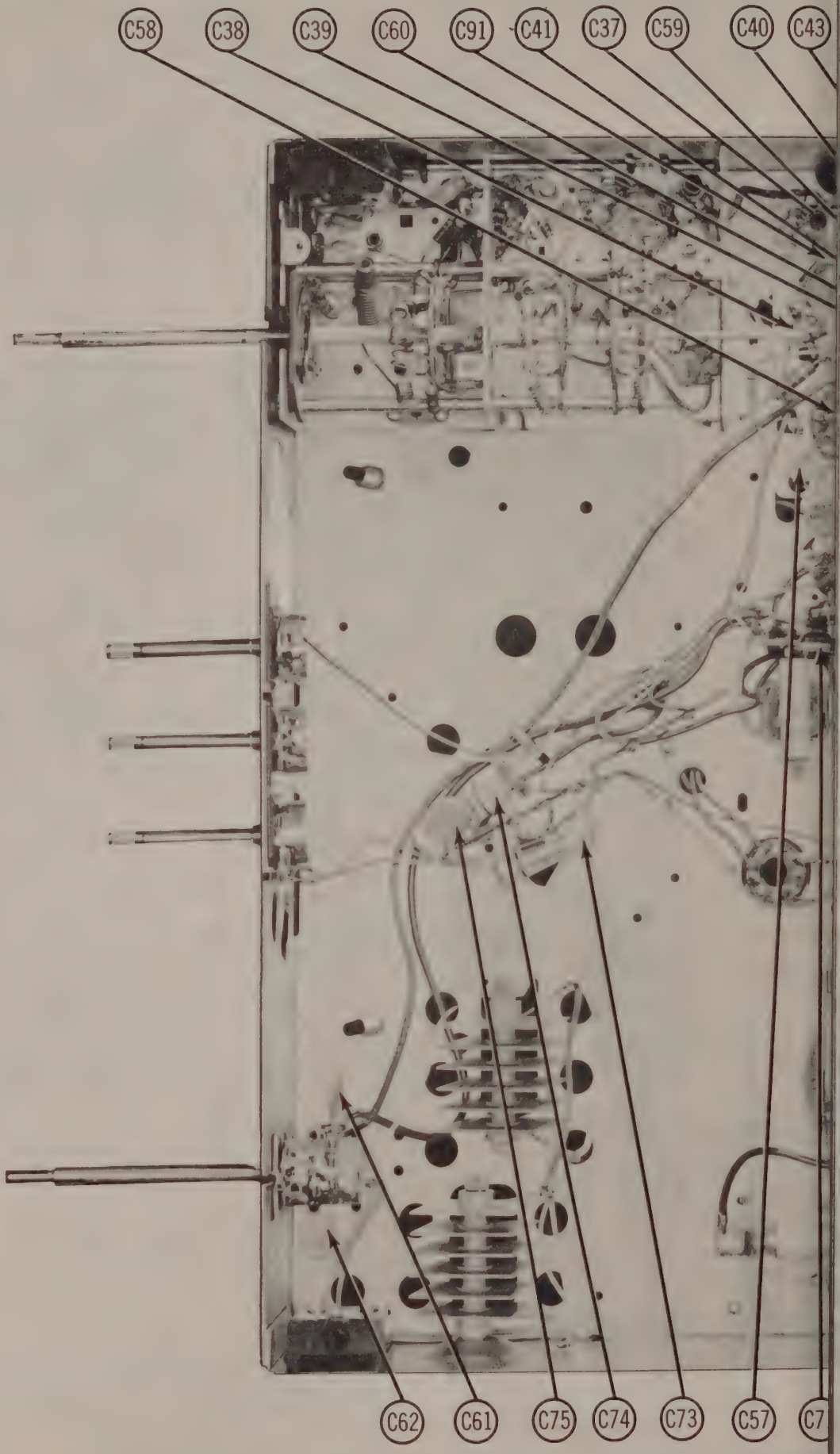
LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V2, V3, V4, V5, V10
No pic, no sound, has snow - V1, V2, V3
No pic, has sound, has raster - V6, V7
Has pic, no sound - V7, V8, V9, V10

SYNC FAILURE
No vert. sync - V11, V12
No horiz. sync - V9, V11, V13
No vert. or horiz. sync - V11

SWEEP FAILURE
No raster, has sound - V13, V14, V15, V16, V17
No vertical deflection - V12
Poor vert. linearity or foldover - V12
Poor horiz. linearity or foldover - V13, V14, V15
Narrow picture - V13, V14, V15, V16, M1, M2
Vert. off freq. - V11, V12
Horiz. off freq. - V9, V11, V13

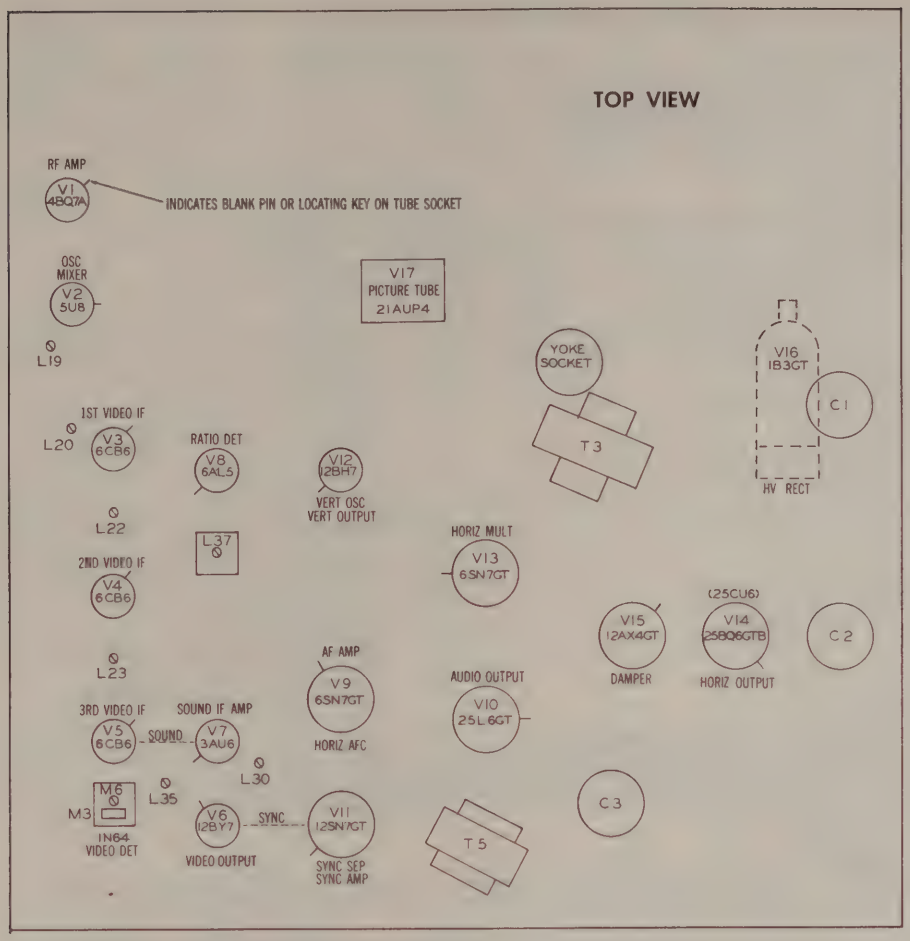
NOTE: Since this receiver employs tubes used in series-parallel filament network, an open filament in any tube in series may cause the set to be inoperative. (See circuit below).





CHASSIS BOTTOM VIEW

TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

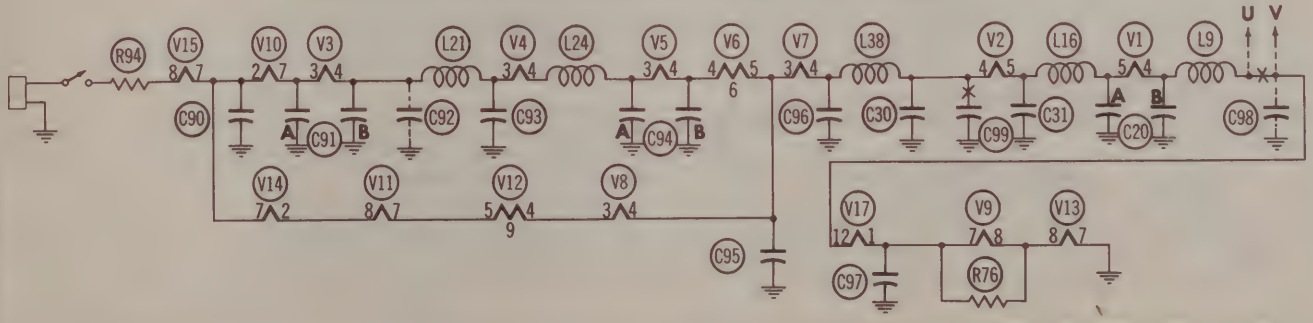
POWER SUPPLY FAILURE
No raster, no sound - **Selenium Rectifiers (M1 & M2)**

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - **V2, V3, V4, V5, V10**
No pic, no sound, has snow - **V1, V2, V3**
No pic, has sound, has raster - **V6, V7**
Has pic, no sound - **V7, V8, V9, V10**

SYNC FAILURE
No vert. sync - **V11, V12**
No horiz. sync - **V9, V11, V13**
No vert. or horiz. sync - **V11**

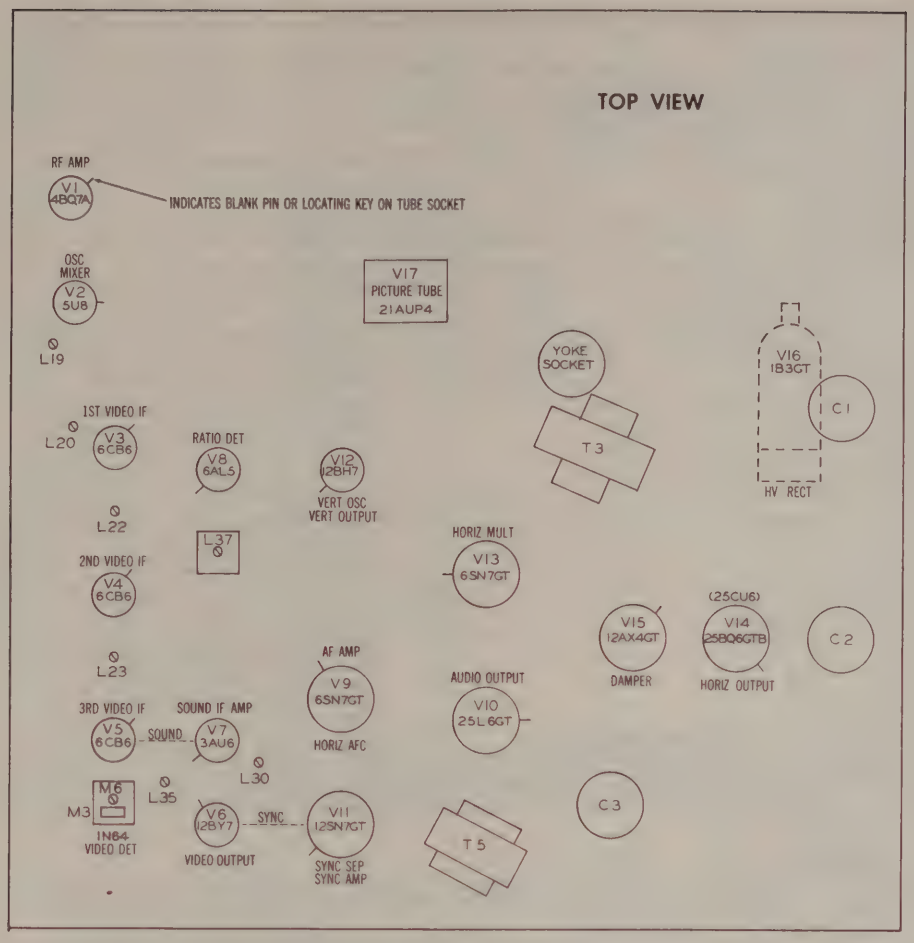
SWEEP FAILURE
No raster, has sound - **V13, V14, V15, V16, V17**
No vertical deflection - **V12**
Poor vert. linearity or foldover - **V12**
Poor horiz. linearity or foldover - **V13, V14, V15**
Narrow picture - **V13, V14, V15, V16, M1, M2**
Vert. off freq. - **V11, V12**
Horiz. off freq. - **V9, V11, V13**

NOTE: Since this receiver employs tubes used in series-parallel filament network, an open filament in any tube in series may cause the set to be inoperative. (See circuit below).



CHASSIS BOTTOM VIEW

TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

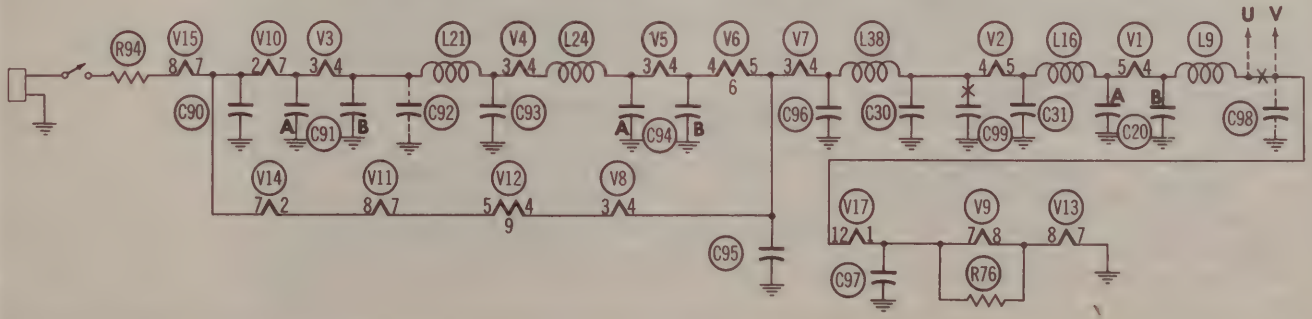
POWER SUPPLY FAILURE
No raster, no sound - **Selenium Rectifiers (M1 & M2)**

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - **V2, V3, V4, V5, V10**
No pic, no sound, has snow - **V1, V2, V3**
No pic, has sound, has raster - **V6, V7**
Has pic, no sound - **V7, V8, V9, V10**

SYNC FAILURE
No vert. sync - **V11, V12**
No horiz. sync - **V9, V11, V13**
No vert. or horiz. sync - **V11**

SWEEP FAILURE
No raster, has sound - **V13, V14, V15, V16, V17**
No vertical deflection - **V12**
Poor vert. linearity or foldover - **V12**
Poor horiz. linearity or foldover - **V13, V14, V15**
Narrow picture - **V13, V14, V15, V16, M1, M2**
Vert. off freq. - **V11, V12**
Horiz. off freq. - **V9, V11, V13**

NOTE: Since this receiver employs tubes used in series-parallel filament network, an open filament in any tube in series may cause the set to be inoperative. (See circuit below).



ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Use an isolation transformer to protect the test equipment.
Maintain 117V line voltage. If necessary use a variac.
Disconnect yoke from plug connection. This will eliminate the high voltage shock hazard and reduce scope interference during alignment. Connect a 2500Ω 10 watt resistor between pin 5 of service test receptacle and chassis.

VIDEO IF ALIGNMENT

Connect the negative lead of a 3 Volt battery to pin 1 of service test receptable. Connect the positive lead to chassis.
Disable the local oscillator by shorting pin 9 (grid) of 5U8 (V2B) to chassis with a short lead.
The IF coils and traps have two points of resonance. The correct settings are with the cores away from the center of the coil form so as not to affect coupling between coil and trap windings.
Set constrast control fully counter clockwise.
Set area selector switch to its "local" position.
Attenuate the sweep generator to maintain 3 to 5 volts peak to peak at point Ⓐ. If sweep generator has no built-in markers, loosely couple the output of an accurately calibrated AM signal generator to the video IF Test strip (point Ⓑ). Attenuate marker generator low enough to prevent distortion of the response curves.
Connect the synchronised sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	.005MFD	High side to point Ⓑ. Low side to chassis.	44MC (50MC Swp)	41.25MC	13	Vert. Amp. thru 47KΩ to point Ⓐ. Low side to chassis.	A1	Adjust so that trap notch falls at 41.25MC. Use sufficient generator output so that trap notch is clearly defined. (Fig. 1).
2.	"	"	"	47.25MC	"	"	A2	Adjust so that trap notch falls at 47.25MC. Temporarily remove the -3 volt bias to provide better trap notch definition (Fig. 1).
3.	"	"	"	42.25MC	"	"	A3	Adjust to place 43.25MC marker at 50% on response curve (Fig. 1).
4.	"	"	"	45.75MC	"	"	A4, A5	Adjust A4 to place 45.75MC marker at 50% on high side of response curve. Simultaneously adjust A5 for flat-top and symmetrical response similar to Fig. 1.
5.	"	High side to point Ⓒ. Low side to chassis.	"	41.25MC 42.25MC 45.75MC 47.25MC	"	"	A6, A7	Simultaneously adjust A6 and A7 for response similar to Fig. 2. A6 positions curve and A7 has leveling effect. If necessary, retouch A1 thru A5 for desired response with correct marker positions as in Fig. 2. Increase sweep generator output to observe 41.25MC and 47.25 MC trap markers.

REGENERATION CHECK

Leave pin 9 of V2B shorted to chassis and remove the 3 volt bias supply. With generator and scope connected as in step 5, observe response curve. Any regeneration will be indicated by sharp peaks on the response curve. Remove short from pin 9 of V2B and chassis.

SOUND IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Connect two matched 100KΩ (1%) resistors in series from point Ⓓ to chassis. The junction of these two resistors is alignment point Ⓔ as shown on the schematic.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
6.	Direct	High side to point Ⓐ. Low side to chassis.	4.5MC (Unmod)	Any non-interfering channel	DC probe thru 1MΩ to point Ⓔ. Common to chassis.	A8, A9	Adjust for maximum deflection.
7.	"	"	"	"	DC probe to point Ⓔ. Common to point Ⓓ	A10	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting. Check steps 6 and 7 for best accuracy.

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60% modulation and 450KC sweep. Use 120% sawtooth voltage in scope for horizontal deflection.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
6.	Direct	High side to point Ⓐ. Low side to chassis.	4.5MC (450KC Swp)	4.5MC	Any non-interfering channel	Vert. Amp. to point Ⓐ. Low side to chassis.	A8, A9	Disconnect stabilizing capacitor C4A. Adjust for curve of maximum amplitude and symmetry similar to Fig. 3.
7.	"	"	"	"	"	Vert. Amp. to point Ⓐ. Low side to chassis.	A10	Reconnect stabilizing capacitor C4A. Adjust so that 4.5MC occurs at center of crossover lines as in Fig. 4. SLIGHTLY retouch A9 for maximum amplitude and straightness of crossover lines.

SOUND IF ALIGNMENT USING TV SIGNAL AND VTVM

This method provides an accurate signal source. Tune in a TV station. See steps 6 and 7 of "Sound IF Alignment Using AM Signal Generator and VTVM" for VTVM connections and for adjustment of A8, A9 and A10.

4.5MC TRAP ALIGNMENT

Set contrast control fully clockwise.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
8.	Direct	High side to point Ⓐ. Low side to chassis.	4.5MC (Unmod)	Any non-interfering channel	DC probe thru detector (Fig. 8) to pin 11 (cathode) of picture tube. Common to chassis.	A-11	Adjust for MINIMUM deflection.

ALTERNATE 4.5MC TRAP ALIGNMENT

Tune in a local TV station. Adjust fine tuning control until a noticeable 4.5MC beat appears in the picture. Adjust A11 for minimum 4.5MC beat in the picture. Adjust A11 so that the core is approximately centered between the points where the 4.5MC beat appeared in the picture.

RF AND MIXER ALIGNMENT

Set the area selector switch to "Fringe" position.
Use only enough sweep generator output for useable pattern on scope.
Connect the synchronised sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.
Remove tuner shield.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
9.	Two 120Ω Carbon Resistor	Across antenna terminals with 120Ω in each lead. Use very short leads.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. Amp. thru 47KΩ to point Ⓐ. Low side to chassis.	A12, A13	Adjust for maximum amplitude and response similar to Fig. 8. Adjust by compressing or expanding coil turns.

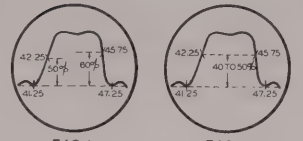


FIG. 1

FIG. 2

FIG. 3

FIG. 4

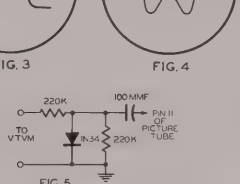


FIG. 5

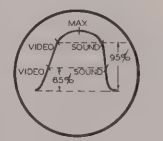


FIG. 6

FIG. 7

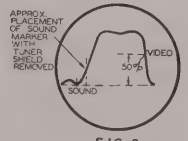


FIG. 8

RF AND MIXER ALIGNMENT (CONT.)

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
10.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead. Use very short leads.	177MC (20MC Swp)	175.25MC 179.75MC	7	Vert. Amp. thru 47KΩ to point Ⓐ. Low side to chassis.	A14	Adjust for response similar to Fig. 6. Be sure all markers fall within limits shown. Recheck channel 13. If necessary, retouch A13 adjustment SLIGHTLY.
11.	"	"	207MC (10MC Swp) 201MC (10MC Swp) 195MC (10MC Swp) 189MC (10MC Swp) 183MC (10MC Swp)	205.25MC 209.75MC 199.25MC 203.75MC 193.25MC 197.75MC 187.25MC 191.75MC 181.25MC 185.75MC	12 11 10 9 8	"		Check for response curve similar to Fig. 7 on each channel. (If response is checked with tuner shield cover in place the video marker will move up the curve a short distance, but markers should be within limits
12.	"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A15, A20	Adjust A15 by compressing or expanding coil turns to obtain response similar to Fig. 7 with markers not falling below 50%. Usually the antenna coils A30 thru A34 are not to be adjusted. If the antenna coils have been distorted, they may be adjusted by compressing or expanding coil turns for maximum response in conjunction with the RF coils (A15 thru A19).
13.	"	"	79MC (10MC Swp)	77.25MC 81.75MC	5	"	A16, A21	Adjust A16 by compressing or expanding coil turns for response similar to Fig. 7. For A21 see remarks step 12.
14.	"	"	69MC (10MC Swp)	67.25MC 71.75MC	4	"	A17, A22	Adjust A17 for response similar to Fig. 7. For A22 see remarks step 12.
15.	"	"	63MC (10MC Swp)	61.25MC 65.75MC	3	"	A18, A23	Adjust A18 for response similar to Fig. 7. For A23 see remarks step 12.
16.	"	"	57MC (10MC Swp)	55.25MC 59.75MC	2	"	A19, A24	Adjust A19 for response similar to Fig. 7. For A24 see remarks step 12. Replace tuner shield and recheck channels 13 thru 2. Response on channels 6 thru 2 must be similar to Fig. 7 with marker not falling below 50% on response curve.
17.	Direct	High side to point Ⓐ. Low side to chassis.	44MC (10MC Swp)	42.25MC 45.75MC	UHF	"	A25, A26	Remove tuner shield. Remove UHF shorting plug at point Ⓐ. Preset A26 slug maximum clockwise. Adjust A25 and A26 for response similar to Fig. 7. A25 is adjusted by expanding or compressing coil turns. Replace UHF shorting plug.

OSCILLATOR ALIGNMENT

Remove shorting jumper from pin 9 to V2B and chassis. Replace the 3 volt bias supply as under "Video IF Alignment". Use only enough sweep generator output from generator to produce useable pattern on scope.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.
Set the fine tuning control to the mid-position of its range.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
18.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	195MC (10MC Swp) 189MC (10MC Swp) 183MC (10MC Swp) 177MC (10MC Swp)	193.25MC 197.75MC 187.25MC 191.75MC 181.25MC 185.75MC 175.25MC 179.75MC	10 9 8 7	Vert. Amp. thru 47KΩ to point Ⓐ. Low side to chassis.	A27	Adjust to place sound marker SLIGHTLY higher than the sound trap notch. This allowance must be made due to the removal of tuner shield. With shield replaced, the sound marker should move down into the trap notch. Check channels 7 thru 13 noting if sound marker for each channel falls just above the trap notch. Response should be similar to Fig. 8. If more than a 30 degree rotation of fine tuning control is necessary to place sound marker in proper position on any high band adjust A28. If A28 is adjusted it may be necessary to readjust A27 on channel 10.
19.	"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A29	Check to see that fine tuning is at its mid-range capacity. Adjust A29 by compressing or expanding coil to place sound marker just above trap notch (Fig. 8)
20.	"	"	79MC (10MC Swp) 69MC (10MC Swp) 63MC (10MC Swp) 57MC (10MC Swp)	77.25MC 81.75MC 67.25MC 71.75MC 61.25MC 65.75MC 55.25MC 59.75MC	5 4 3 2	"	A30 A31 A32 A33	Adjust by compressing or expanding coil to place sound marker just above trap notch (Fig. 8) with fine tuning set within 15 degrees of mid-position.

45.0MC TRAP ALIGNMENT

Instructions same as for "RF and Mixer Alignment".

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
21.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	45MC (10MC Swp)	45MC	2	Vert. Amp. to point Ⓐ. Low side to chassis.	A34	Increase sweep generator output to produce visible marker on scope. Adjust A34 for MINIMUM response at 45MC.

IF SENSITIVITY MEASUREMENT

Set contrast control for minimum contrast (fully counter clockwise).
Set area selector switch to "Fringe" position. Set channel selector to channel 13.
Connect the high side of an AM signal generator to point Ⓑ. Low side to chassis. Set signal generator to 45.0MC.
Connect the DC probe of a VTVM to point Ⓔ. Common to chassis.
A signal less than 500 microvolts from the generator should produce one volt on VTVM. Short out R17 with a clip lead and move high side of signal generator to point Ⓒ. Low side to chassis.
A signal less than 60 microvolts from the generator should produce one volt on VTVM.
Remove short from R17.

UHF TUNER ALIGNMENT

This portion of the receiver has been properly aligned at the factory and is very stable. Alignment of this portion of the receiver should not be required in the field.

MOTOROLA MODELS: 21K29, B, W, Y21K29, B, W, 21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B (CH. TS-531, Y, WTS-531, Y)

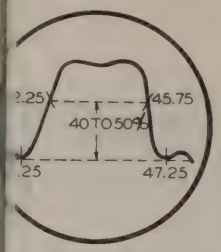


FIG. 2

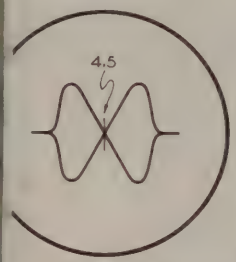


FIG. 4

00 MMF
PIN 11 OF PICTURE TUBE
20K

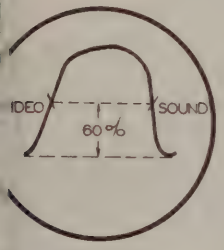
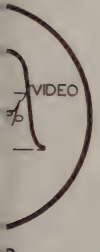


FIG. 7



B

RF AND MIXER ALIGNMENT (CONT.)

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
10.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead. Use very short leads.	177MC (10MC Swp)	175.25MC 179.75MC	7	Vert. Amp. thru 47KΩ to point Ⓒ. Low side to chassis.	A14	Adjust for response similar to Fig. 6. Be sure all markers fall within limits shown. Recheck channel 13. If necessary, retouch A12 adjustment SLIGHTLY.
11.	"	"	207MC (10MC Swp)	205.25MC 209.75MC	12	"		Check for response curve similar to Fig. 6 on each channel. (If response is checked with tuner shield cover in place the video marker will move up the curve a short distance, but markers should be within limits
			201MC (10MC Swp)	199.25MC 203.75MC	11			
			195MC (10MC Swp)	193.25MC 197.75MC	10			
			189MC (10MC Swp)	187.25MC 191.75MC	9			
			183MC (10MC Swp)	181.25MC 185.75MC	8			
12.	"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A15, A20	Adjust A15 by compressing or expanding coil turns to obtain response similar to Fig. 7 with markers not falling below 60%. Usually the antenna coils A20 thru A24 are not to be adjusted. If the antenna coils have been distorted, they may be adjusted by compressing or expanding coil turns for maximum response in conjunction with the RF coils (A15 thru A19).
13.	"	"	79MC (10MC Swp)	77.25MC 81.75MC	5	"	A16, A21	Adjust A16 by compressing or expanding coil turns for response similar to Fig. 7. For A21 see remarks step 12.
14.	"	"	69MC (10MC Swp)	67.25MC 71.75MC	4	"	A17, A22	Adjust A17 for response similar to Fig. 7. For A22 see remarks step 12.
15.	"	"	63MC (10MC Swp)	61.25MC 65.75MC	3	"	A18, A23	Adjust A18 for response similar to Fig. 7. For A23 see remarks step 12.
16.	"	"	57MC (10MC Swp)	55.25MC 59.75MC	2	"	A19, A24	Adjust A19 for response similar to Fig. 7. For A24 see remarks step 12. Replace tuner shield and recheck channels 13 thru 2. Response on channels 6 thru 2 must be similar to Fig. 7 with marker not falling below 60% on response curve.
17.	Direct	High side to point Ⓖ. Low side to chassis.	44MC (10MC Swp)	42.25MC 45.75MC	UHF	"	A25, A26	Remove tuner shield. Remove UHF shorting plug at point Ⓖ. Preset A26 slug maximum clockwise. Adjust A25 and A26 for response similar to Fig. 7. A25 is adjusted by expanding or compressing coil turns. Replace UHF shorting plug.

OSCILLATOR ALIGNMENT

Remove shorting jumper from pin 9 to V2B and chassis. Replace the 3 volt bias supply as under "Video IF Alignment". Use only enough sweep generator output from generator to produce useable pattern on scope.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
18.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	195MC (10MC Swp)	193.25MC 197.75MC	10	Vert. Amp. thru 47KΩ to point Ⓐ. Low side to chassis.	A27	Adjust to place sound marker SLIGHTLY higher than the sound trap notch. This allowance must be made due to the removal of tuner shield. With shield replaced, the sound marker should move down into the trap notch. Check channels 7 thru 13 noting if sound marker for each channel falls just above the trap notch. Response should be similar to Fig. 8. If more than a 30 degree rotation of fine tuning control is necessary to place sound marker in proper position on any high band adjust A28. If A28 is adjusted it may be necessary to readjust A27 on channel 10.
			213MC (10MC Swp)	211.25MC 215.75MC	13			
			207MC (10MC Swp)	205.25MC 209.75MC	12			
			201MC (10MC Swp)	199.25MC 203.75MC	11			
			189MC (10MC Swp)	187.25MC 191.75MC	9			
			183MC (10MC Swp)	181.25MC 185.75MC	8			
			177MC (10MC Swp)	175.25MC 179.75MC	7			
19.	"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A29	Check to see that fine tuning is at its mid-range capacity. Adjust A29 by compressing or expanding coil to place sound marker just above trap notch (Fig. 8)
20.	"	"	79MC (10MC Swp)	77.25MC 81.75MC	5	"	A30	Adjust by compressing or expanding coil to place sound marker just above trap notch (Fig. 8) with fine tuning set within 15 degrees of mid-position.
			69MC (10MC Swp)	67.25MC 71.75MC	4		A31	
			63MC (10MC Swp)	61.25MC 65.75MC	3		A32	
			57MC (10MC Swp)	55.25MC 59.75MC	2		A33	

45.0MC TRAP ALIGNMENT

Instructions same as for "RF and Mixer Alignment".

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
21.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	45MC (10MC Swp)	45MC	2	Vert. Amp. to point Ⓒ. Low side to chassis.	A34	Increase sweep generator output to produce visible marker on scope. Adjust A34 for MINIMUM response at 45MC.

IF SENSITIVITY MEASUREMENT

Set contrast control for minimum contrast (fully counter clockwise).
Set area selector switch to "fringe" position. Set channel selector to channel 13.
Connect the high side of an AM signal generator to point Ⓑ. Low side to chassis. Set signal generator to 45.0MC.
Connect the DC probe of a VTVM to point Ⓐ. Common to chassis.
A signal less than 500 microvolts from the generator should produce one volt on VTVM. Short out R17 with a clip lead and move high side of signal generator to point Ⓒ. Low side to chassis.
A signal less than 60 microvolts from the generator should produce one volt on VTVM.
Remove short from R17.

UHF TUNER ALIGNMENT

This portion of the receiver has been properly aligned at the factory and is very stable. Alignment of this portion of the receiver should not be required in the field.

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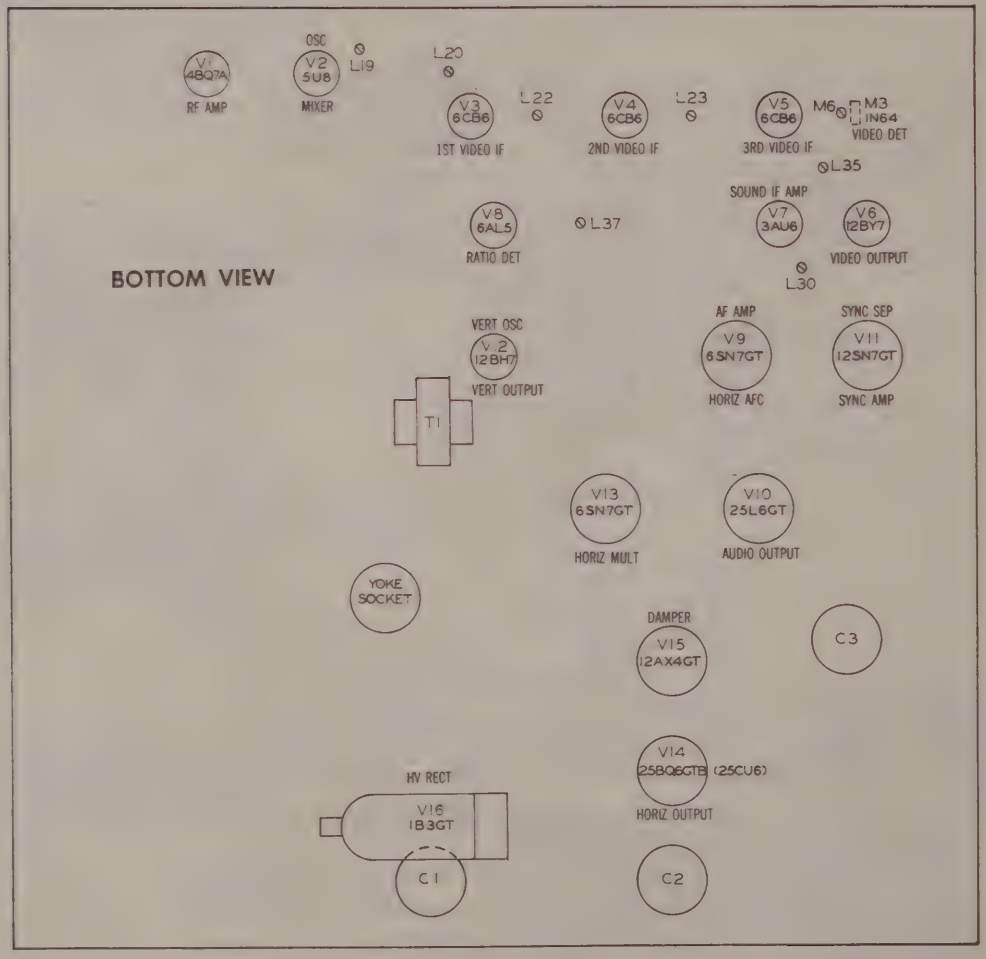
3004 MAIN ST.
DENVER, COLORADO

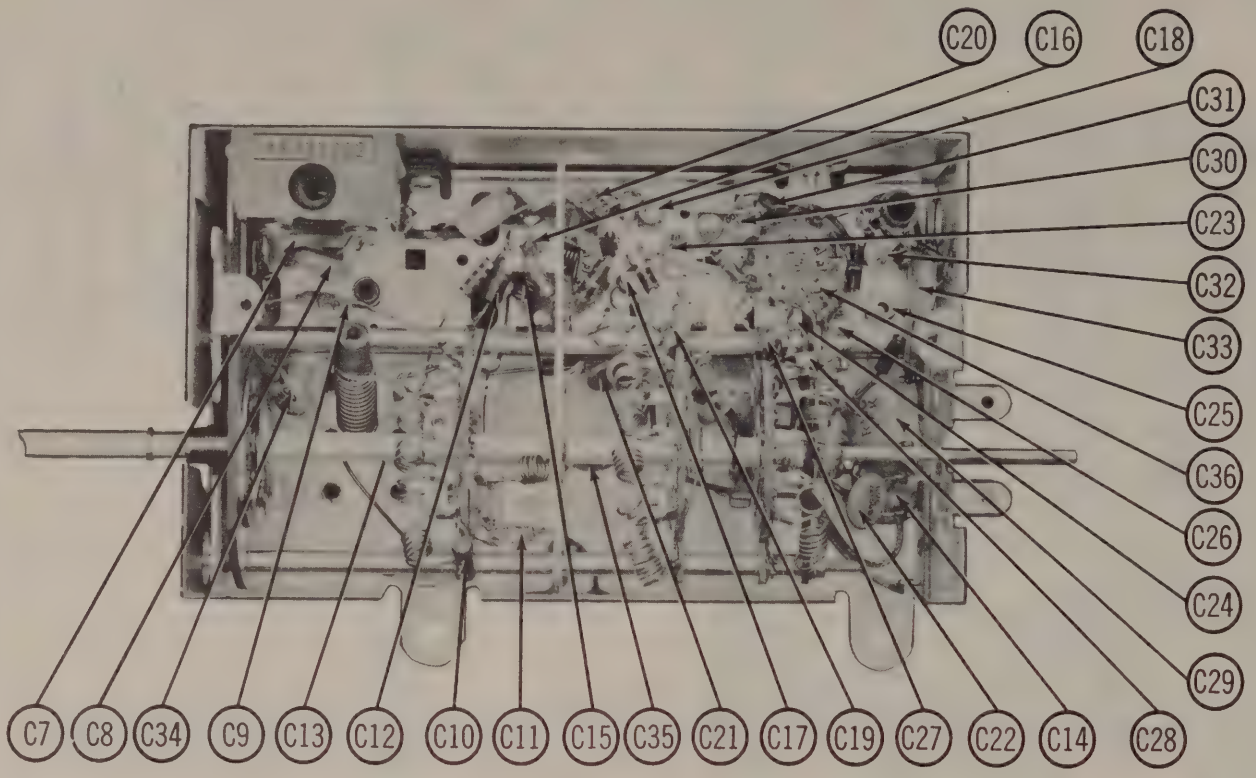
RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	4BQ7A	Inf.	250KΩ	0Ω	5Ω	6Ω	†3. 4KΩ	Inf.	Inf.	0Ω
V 2	5U8	■2KΩ	180KΩ	■220KΩ	7Ω	6Ω	■16KΩ	0Ω	0Ω	15KΩ
V 3	6CB6	180KΩ	47Ω	20Ω	18Ω	■1KΩ	■1KΩ	0Ω		
V 4	6CB6	180KΩ	47Ω	18Ω	16Ω	■1KΩ	■1KΩ	0Ω		
V 5	6CB6	. 1Ω	120Ω	16Ω	14Ω	■1KΩ	†17KΩ	0Ω		
V 6	12B47	170Ω	1Meg	170Ω	14Ω	8Ω	11Ω	†4KΩ	†22KΩ	170Ω
V 7	3AU6	■2. 2KΩ	■220Ω	8Ω	7Ω	†300Ω	†300Ω	■370Ω		
V 8	6AL5	Inf.	Inf.	12Ω	8Ω	22KΩ	0Ω	0Ω		
V 9	6SN7GT	300KΩ	22KΩ	100KΩ	350KΩ	†33KΩ	1. 5KΩ	3Ω	2Ω	
V 10	25L6GT	TP	22Ω	†400Ω	†90Ω	200KΩ	TP	20Ω	200KΩ	
V 11	12SN7GT	1. 2Meg	■1Meg	170Ω	22KΩ	■9. 5KΩ	2. 2KΩ	22Ω	18Ω	
V 12	12BH7	▲1KΩ	▲3Meg	9KΩ	12Ω	18Ω	▲3Meg	650KΩ	50Ω	16Ω
V 13	6SN7GT	5Meg	†10KΩ	1KΩ	150KΩ	†70KΩ	1KΩ	0Ω	2Ω	
V 14	25BQ6GTB	TP	21Ω	TP	†330Ω	330KΩ	NC	22Ω	0Ω	TOP CAP ▲34Ω
V 15	12AX4GT	TP	NC	Inf.	TP	†90Ω	TP	22Ω	25Ω	
V 16	1B3GT		PINS	1-8	HAVE	INF	RESISTANCE			TOP CAP ▲275Ω
V 17	21AUP4	3Ω	†2. 7Meg	PIN 6 ▲16Ω	PIN 10 ▲16Ω	PIN 11 †130KΩ	PIN 12 5Ω			

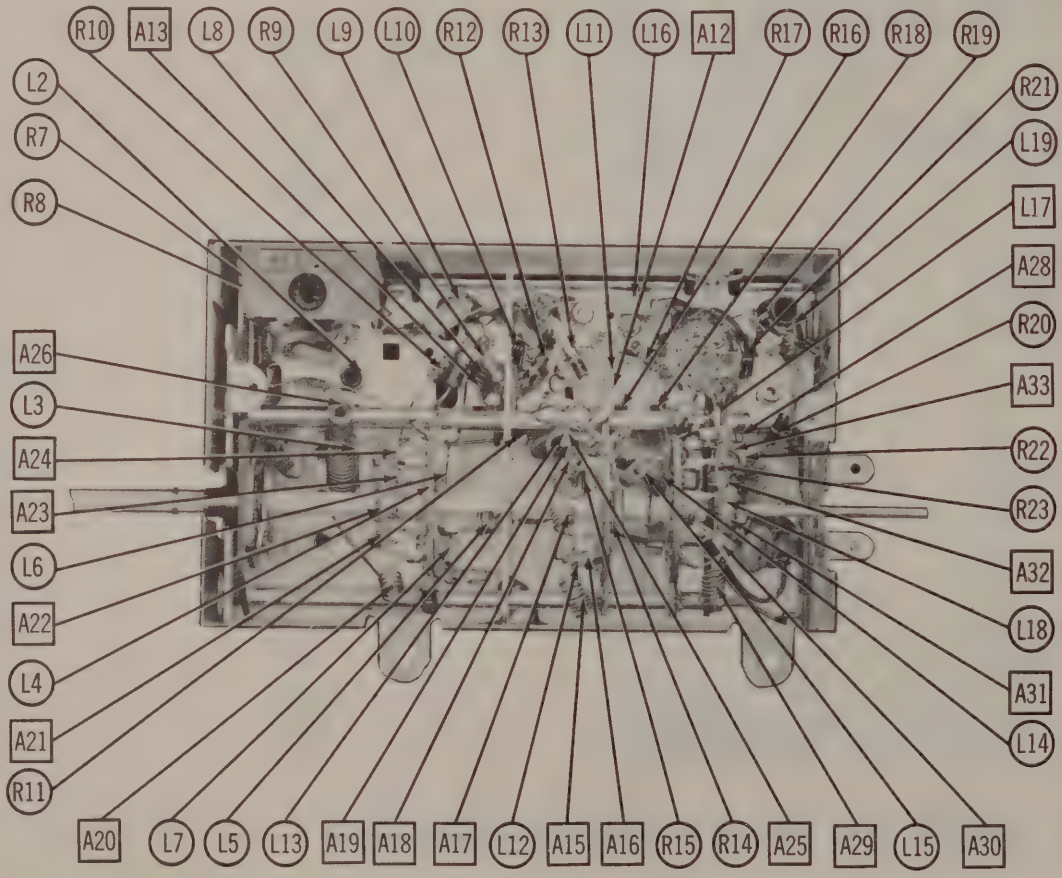
†MEASURED FROM OUTPUT OF M2.
■MEASURED FROM 145V LINE.
▲MEASURED FROM PIN 3 OF V15.
NC-NO CONNECTION.
TP-TIE POINT.



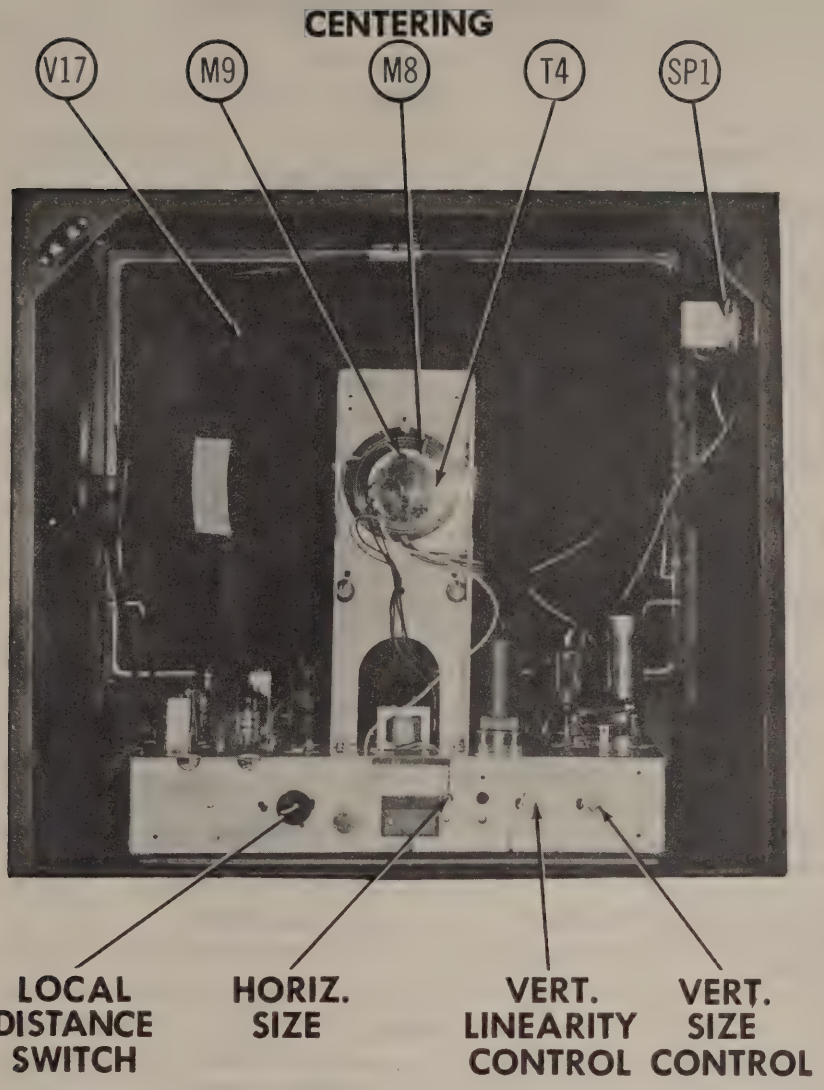
TUBE PLACEMENT CHART



RF TUNER-BOTTOM VIEW



RF TUNER-BOTTOM VIEW



CABINET—REAR VIEW

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[illegible]
DEANTS, CALIFORNIA

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern.

Normally the horizontal hold control will have a sync range of approximately 50 degrees. If the control is too critical, adjust as follows:

1. Set the area selector switch to "Local" position and all other controls for a normal picture.
2. Short out the AFC voltage. Shunt the horizontal oscillator coil (L39) to ground with a .1MFD 400V capacitor. This may be done with the chassis in cabinet by using the three pin socket on rear of chassis labeled "Test Receptable only".
3. Adjust the horizontal hold control to the point where picture remains stable horizontally.
4. Remove the .1MFD capacitor from L39 and adjust the horizontal oscillator slug (B1) to the point where picture remains stable horizontally.
5. Remove short from AFC voltage and adjust the horizontal hold control until picture remains in sync over approximately 30 degrees of its range while switching off channel and back again.

Adjust the horizontal size control for a picture slightly wider than necessary to fill the picture mask horizontally.

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage."

INSUFFICIENT SWEEP

Check by substitution V10, V14 and V15. Check M1 and M2. Check C85, C86, R89, R91, T2, T4A and other associated components.

DRIVE LINES

Check by substitution V10, V14 and V15. Check T2, T4A, C85, C86, R91 and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V10, V14 and V15. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines."

PIE CRUST EFFECT

Check by substitution V13, V14 and V15. Check C81 for open. Check L39, C80, R81 and other associated components.

XMAS TREE EFFECT

Check by substitution V13, V14 and V15. Check T2 and T4 for internal arcing. Check L39, C78, C79, C83, C84, R78, R85 and other associated components.

VERTICAL

LOSS OF SWEEP

Substitute V12. Check waveform W7.

If Satisfactory	If Unsatisfactory
Check T3, T4B, R73, R5 and other associated components.	Check T1, C6, C72, R6 and other associated components.

INSUFFICIENT SWEEP

Substitute V12. Check vertical size and vertical linearity controls for proper operation and other associated components.

COMPRESSED AT BOTTOM

Substitute V12. Check R6, C6, C72, T1 and other associated components.

COMPRESSED AT TOP

Substitute V12. Check T3, C2C, R73, R5 and other associated components.

FOLDS

Substitute V12. Check C73, C74, T3, T4B and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Substitute V11. Check C66, C67, C68, R64, R68, R69 and other associated components.

LOSS OF VERTICAL SYNC-HORIZONTAL SYNC SATISFACTORY

Substitute V12. Check vertical integrator network. Check R4, T1, C72 and other associated components.

LOSS OF HORIZONTAL SYNC-VERTICAL SYNC SATISFACTORY

Check by substitution V9 and V13. Check C76, C77, C80, C81, R81, L39 and other associated components.

HORIZONTAL BENDING

Check by substitution V9, V11 and V13. Check horizontal AFC network.

VIDEO

LOSS OF VIDEO

Substitute V6. Check C49, C50, C52, L32, R43, R44 and other associated components.

SOUND BARS(4.5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check adjustment A-11. Check video IF alignment.

POOR CONTRAST

Substitute V6. Check contrast control. Check video crystal detector network. Check L31, L33, R46, C49, C52 and other associated components.

NEGATIVE PICTURE

Substitute V6. Check picture tube. Check C49, C52, R46, R44 and other associated components.

SMEAR

Substitute V6. Check L26, L27, L28, L29, L31, L33, C49, C52 and other associated components.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V1, V3, V4, V5 and V6 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V7, V8, V9 and V10. Check stages V9 and V10 using audio signal generator. Apply audio signal across R18.

If Satisfactory	If Unsatisfactory
Check ratio detector and audio IF stages for component failure or change of value.	Check C60, C63, C64, C4B, R59, T5, speaker and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustment A10 for minimum buzz. If still unsatisfactory, check audio IF alignment.

DISTORTED

Follow procedure outlined under "Weak or no Sound."

POWER

DEAD SET

If filaments fail to light, check all tubes. These tubes are connected in series. Check AC interlock assembly. Check switch on volume control and R94. If filaments light, check M1, M2, C1 and R95. Check B+ filter and decoupling network.

SMALL AND/ON DIM PICTURE

Check M1, M2, R95 and C1. Check B+ filter and decoupling network.

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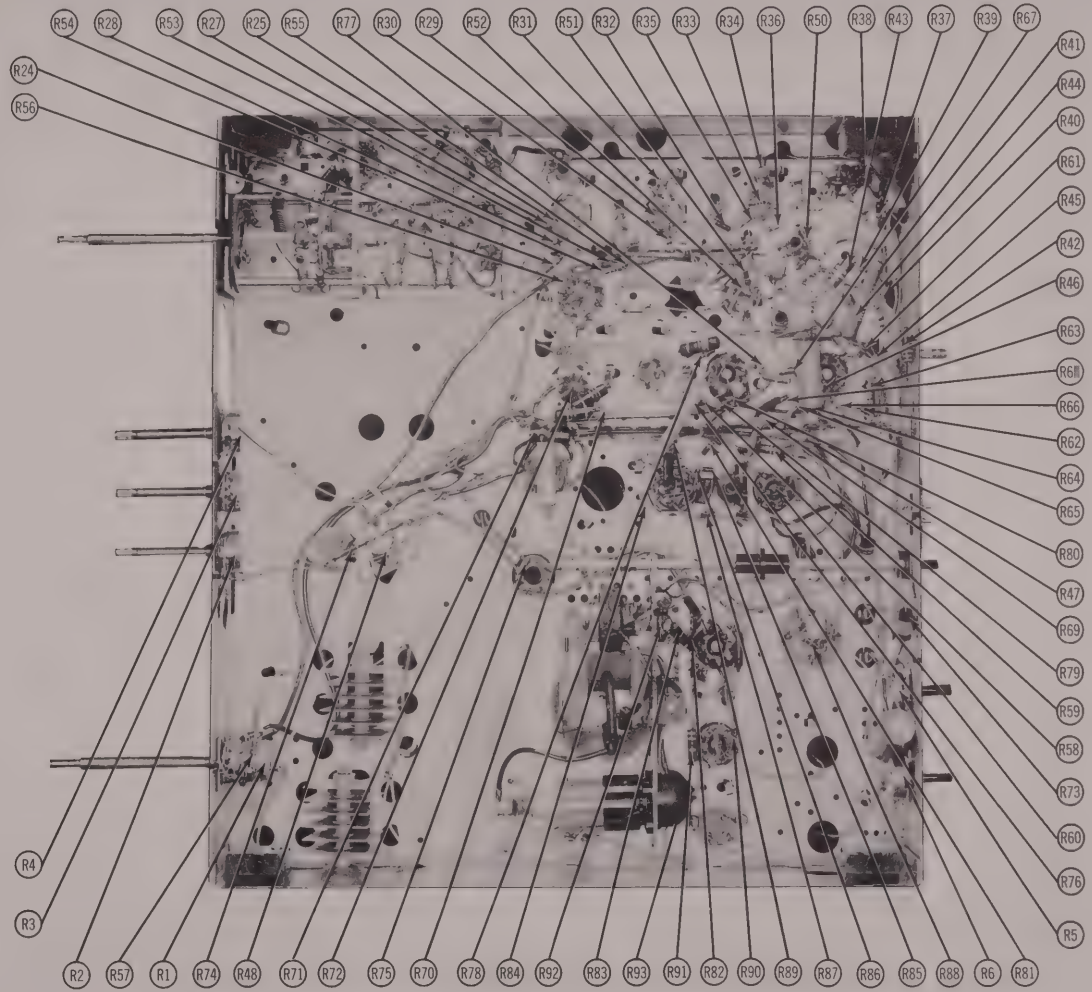
DENVER, COLORADO

PRODUCTION CHANGES

Ch. TS-531	The following production changes were made during production. Whenever possible the reason for the change is also given. COMPONENT CHANGE R9, 820Ω resistor, added from the junction of C15 and C16 to ground.
Ch. TS-531A-01	TO REDUCE REGENERATION C37 and L20 are removed from the junction of R25 and R26. R29 is decreased from 47KΩ to 15KΩ. R25 is decreased from 22KΩ to 15KΩ.
Ch. TS-531A-02	TO REDUCE REGENERATION R26 is omitted. C38 is connected from R25 to ground.
Ch. TS-531A-03	TO LIMIT BRIGHTNESS LEVEL R47 is omitted. C53 is omitted. R46 is increased from 100KΩ to 220KΩ. R49 is decreased from 220KΩ to 100KΩ. R49 is removed from ground and connected to the 145V line. Pin 8 of deflection yoke (T4) is removed from 245V line and connected to boost, 490V. TO PREVENT ARCING AT MAXIMUM AUDIO LEVEL A 100Ω resistor added from pin 3 of V10 to blue lead of T5.
Ch. TS-531A-04	TO ELIMINATE AUDIO OSCILLATION C55 is replaced by two single 1000MMF capacitors. TO INCREASE HORIZONTAL SIZE R89 is increased from 4.7KΩ to 6.8KΩ. R91 is increased from 330Ω to 5.6KΩ. A .1MFD capacitor added from pin 4 of V14 to ground. R58 is increased from 1.5KΩ to 1.8KΩ. C59 is omitted. R51 is connected to ground. The suppressor grid (pin 2 of V7) is connected directly to ground.
Ch. TS-531A-05	COMPONENT CHANGE L30 is changed. C51 shunting L30 is decreased from 30MMF to 27MMF.
Ch. TS-531A-06	TO REDUCE TRAILING WHITES L33, shunt peaking coil, wound on 1KΩ resistor. New part #24K736496.
Ch. TS-531A-07	TO IMPROVE SENSITIVITY R9 is omitted. C15 is decreased from 3MMF to 1.5MMF. A 2.2MMF capacitor added from pin 1 of V2 to ground. With these changes the tuner is changed to part #TT-72A.
Ch. TS-531A-08	TO REDUCE REGENERATION C98 is added from pin 1 of V17 to ground.
Ch. TS-531A-09	COMPONENT CHANGE Horizontal output transformer (T2) is changed to part #24K736082.
Ch. TS-531A-10	COMPONENT CHANGE L35 changed to part #24K736228.



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		MOTOROLA PART No.	STANDARD REPLACEMENT		
V1	RF Amp.	4BQ7A	4BQ7A	9AJ	
V2	Mixer-Osc.	5U8	5U8	9AE	
V3	1st Video IF Amp.	6CB6	6CB6	7CM	
V4	2nd Video IF Amp.	6CB6	6CB6	7CM	
V5	3rd Video IF Amp.	6CB6	6CB6	7CM	
V6	Video Output	12BY7	12BY7	9BF	
V7	Sound IF Amp.	3AU6	3AU6	7BK	
V8	Ratio Det.	6AL5	6AL5	6BT	
V9	AF Amp. - Horiz. AFC	6SN7GT	6SN7GT	8BD	
V10	Audio Output	25L6GT	25L6GT	7S	
V11	Sync Sep. - Sync Amp.	12SN7GT	12SN7GT	8BD	
V12	Vert. Osc. - Vert. Output	12BH7	12BH7	9A	
V13	Horiz Mult.	6SN7GT	6SN7GT	8BD	
V14	Horiz. Output	25BQ6GTB	25BQ6GTB	6AM	25CU6 used as alternate.
V15	Damper	12AX4GT	12AX4GT	4CG	
V16	HV Rect.	1B3GT	1B3GT	3C	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA					RETMA BASE TYPE	NOTES
	MOTOROLA PART No.	CBS PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.		
V17	21AUP4 21AUP4A ①	21AUP4A ①		21AUP4 21AUP4A ②	21AUP4 21AUP4A ①	12L 12L	① Aluminized ② Silver screen

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	MOTOROLA PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1	140	150	23B484097	FP117	TM-140-150	T-055	
C2A	▲100	300	23B731620		TM-3136	Q-162	
B	■200	150				MT-1520	
C	▲60	150					
C3A	▲200	150	23B710941	FP216.1	TM-2029	D-088	
B	▲5	150					
C4A	10	50	23B730205	FP330.5	TM-T10-300	T-095	
B	▲10	50					
C	■10	300					
C5	2	10	23A733205	TC302	TD-2-25	MMT-0505	
C6	10	450	23A702450	TC72	TD-10-450	FM-4510	

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	MOTOROLA PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	
C7	470	2000	21R121478	DD30-471	3KV-471	DC30347	
C8	470	2000	21R121478	DD30-471	3KV-471	DC30347	
C9	150		21R121228	TCN-150	N750-337-151		
C10	6.8		21R120561				
C11	3.3		21R115951	TCZ-3R3	NP0A-3R3	ZT-5533	
C12	470		21R114554	D6-471	GP2K-471	UC-5347	
C13	220		21R410115	DD-221	811-221	UC-5322	
C14	10000		21R482726	DD-103	811-01	DC-511	
C15	3		21R115951	TCZ-3R3	NP0A-030	ZT-553	Note 9.
C16	8.2		21R122084				
C17	1000		21R120672	MFT-1000			
C18	.5-3		21K710943	829-3	3115-01-0R5	CT565A	
C19	1500		21R120100	DD-152	801-0015	DC-5215	
C20A	800		21R400493	DD2-102	812-001	DCD-521	
B	800						
C21	1500		21R120100	DD-152	801-0015	DC-5215	
C22A	1500		21R121406	DD2-152	812-0015	DCD-5215	
B	1500						
C23	10		21R121114	DD-100	831-100	UC-541	
C24	1		21R114071	TCZ-1	NP0A-010		
C25	.5-3		21K710943	829-3	3115-01-0R5	CT565A	
C26	12		21R119132				
C27	2.2			TCZ-2R2	NP0A-2R2		Note 10.
C28	1500		21R120100	DD-152	801-0015	DC-5215	
C29	10000		21R482726	DD-103	811-01	DC-511	
C30A	800		21R400943	DD2-102	812-001	DCD-521	
B	800						
C31	1000		21R115386	DD-102	801-001	DC-521	
C32	470		21R115856	DD-471	831-471	UC-5347	
C33	10000		21R482726	DD-103	811-01	DC-511	
C34	1500		21R120100	DD-152	801-0015	DC-5215	
C35	1500		21R120100	DD-152	801-0015	DC-5215	
C36	1500		21R120100	DD-152	801-0015	DC-5215	
C37	100		21R410036	TCN-100	N750L-101	NT-531	
C38	470		21R410121	DD-471	831-471	UC-5347	
C39	560		21R120936	DD-561	811-561	UC-5356	
C40	50		21R114207	TCN-50	N750K-500	NT-5447	
C41	1000		21R115386	DD-102	801-001	DC-521	
C42	560		21R120936	DD-561	811-561	UC-5356	
C43	1500		21R120100	DD-152	801-0015	DC-5215	
C44	39		21R121468	TCN-39	N750K-390		
C45	1000		21R410127	DD-102	801-001	DD-102	
C46	22		21R120539				
C47	22		21R120539				
C48	470		21K121797	DD-471	831-471	UC-5347	
C49	.1	200	8R121573	DF-104		PT401	
C50	5000		21R115312	DD-502	811-005	DC-525	
C51	30		21R410048				Note 7

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DENVER, COLORADO

CAPACITORS (cont)

ITEM No	RATING CAP	RATING VOLT	REPLACEMENT DATA MOTOROLA PART No	CENTRALAB PART No	ERIE PART No	MALLORY PART No	NOTES
C52	.1	200	8IR121573	DF-104	811-01	DC-511	
C53	10000			DD-103	811-01	DC-511	Note 1
C54	1#		8IR126078	DE-180	831-180	UC-5418	
C55A	4700		3IR121489	DD3-502	811-0047	DC-525	Note 5
B	4700				811-0047	DC-525	Note 6
C56	5000		3IR115312	DD-502	811-006	DC-525	Note 6
C57	5000		3IR115312	DD-502	811-006	DC-525	
C58	470		3IR114564	DD-471	831-471	UC-5347	
C59	1000		31A121679	DD-103	805-001	DC-531	
C60	.005	100	3IR115312	D6-502	GP3-333-503	PT2S2	
C61	5300		3IR120423	D6-332	GP2-333-332	UC-5333	
C62	5000		3IR115312	DD-502	811-006	DC-525	
C63	.01	400	6IR121002	D6-103	GP3-333-103	PT4U	
C64	.05	600	6IR122079	DF-503	81T-05	PT2U2	
C65	10000		3IR463780	DD-103	811-01	DC-511	
C66	4700		3IR120149	DD-472	811-0047	DC-525	
C67	330		3IR115905	D6-331	GP3E-331	UC-5323	
C68	.05	400	6IR121567	DF-503		PT4U5	
C69	.0047	400	6LT34634	D6-472	GP3-333-472	PT2S47	
C70	.0047	400	6LT34634	D6-472	GP3-333-472	PT2S47	
C71	.01	400	6LT34633	D6-103	GP2-333-103	PT4U	
C72	4700		3IR120149	DD-472	811-0047	DC-525	
C73	.05	400	6LK90232	DF-503		PT4U5	
C74	.05	400	6LK90233	DF-508		PT4U5	
C75	5000	3000	3IR120083				
C76	470		3IR114564	DD-471	831-471	UC-5347	
C77	1000		3IR115769	D6-102	GP3L-102	UC-531	
C78	.001	1000	6LK78388	DD-102	1K5KV-102	PT2S21	
C79	.0033	600	6LT34634	D6-472	GP3-333-332	PT2S332	
C80	1000		3IR115386	DD-102	801-001	DC-531	
C81	.01	400	6IR121002	D6-103	GP2-333-103	PT4U	
C82	1000		3IR115800	D6-101	GP3K-101	UC-531	
C83	.0047	400	6LT34634	D6-472	GP3-333-472	PT2S47	
C84	390		31R735757	D6-391	831-391	MC2S43	
C85	390		31R735757	D6-391	831-391	MC2S43	
C86	5000		3IR115312	DD-502	811-006	DC-525	
C87	.1	400		DF-104		PT4U1	
C88	100	2000	3IR121434	DD50-101	81KV-101	DC3031	
C89	39	2000	3IR123131	DD30-390			Note 6
C90	5000	3000	3IR120083				
C91A	500		3IR400963	DD8-102	815-001	DCD-531	Note 3
B	500						Note 3
C92	1500		3IR120100	DD-152	801-0015	DC-5315	Note 3
C93	470		3IR114564	DD-471	831-471	UC-5347	
C94A	470		2IR121866	DD-471	831-471	UC-5347	
B	470			DD-471	831-471	UC-5347	
C95	1000		2IR115386	DD-102	801-001	DC-531	
C96	5000		3IR115312	DD-502	811-006	DC-525	
C97	5000	2000	3IR120093				
C98	5000	3000	3IR115312	DD-502	811-005	DC-525	Note 8
C99	10000			DD-103	81J-01	DC-511	Note 3

Note 1. Not used in chassis 53A-03. (Some versions use 5000MMF in this application (part #2IR115312).
Note 2. Some versions use 470MMF in this application (Part #2IR121866).
Note 3. Not used in some versions.
Note 4. Not used in chassis 53A-04 and later.
Note 5. In chassis 53A-04 and later C58A and C58B are single 10000MMF units.
Note 6. Used only in chassis 53A-04 and later.
Note 7. Chassis 53A-05 use 27MMF in this application.
Note 8. Not used prior to chassis 53A-08.
Note 9. Chassis 53A-07 uses 1. 5MMF in this application.
Note 10. Not used prior to chassis 53A-07.

CONTROLS

ITEM No	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA MOTOROLA PART No	IRC PART No	CLAROSTAT PART No	CENTRALAB PART No	MALLORY PART No	INSTALLATION NOTES
R1A	1500Ω		18B730149	QJ-510	RTV-481	F1-7	UB1998††	Contrast
B	1Meg					R2-59		Volume Tapped at 300KΩ. Attach to R1A.
C	Switch					KB-1		Attach to R1B.
R2A	5Meg		18B730442	QH-141	A47-5Meg-S	AB-97	U-97	Brightness
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R2A.
R3A	100KΩ		18K730145	QH-123	A47-100K-S	AB-40	U-41	Horizontal Hold
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R3A.
R4A	650KΩ		18K730143	QH-123	A47-500K-S	AB-59	U-50	Vertical Hold stop at 500KΩ.
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R4A.
R5A	750Ω		18K730464	QH-105	A47-750-S	AB-5	TAP75U	Vertical Linearity
B	Shaft		Not Req.	TQ	RN-3	AK-19	Not Req.	Attach to R5A.
R6A	5Meg		18B730443	QH-141†	A47-5Meg-S	AB-97	SU-97	Vertical Size stop at 5Meg
B	Shaft		Not Req.	TQ	RN-3	AK-19	Not Req.	Attach to R6A.

* Connect a 350KΩ Resistor in series with the right hand terminal of the control and the lead connecting to the same terminal of the original control (control viewed from the shaft end, terminals down).
† Connect a 1Meg 1 resistor in series with the right hand terminal of the control and the lead connecting to the same terminal of the original control (control viewed from the shaft end, terminals down).
◆ CONCENTRIMIT EQUIVALENT: X-4 KIT, BASE ELEMENTS AND SHAFTS. RI-109, P10-30R (Panel) RI3-137A, R13-131 (Rear) 76-1 Switch

†† Use Mallory #203 and #212 insulating washers to insulate control from chassis.

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA MOTOROLA PART No.	IRC PART No.	NOTES
R7	1Meg		6R6004	BTS-1Meg	
R8	1Meg		6R6004	BTS-1Meg	
R9	820Ω				
R10	22KΩ		6R6397		Note 1
R11	47KΩ		6R6056		Note 2
R12	10KΩ		6R6064		
R13	10Ω		6R5621		
R14	5300Ω		6R6035		
R15	470Ω		6R3949	BTS-470	Note 1
R16	10KΩ		6R6064		
R17	4700Ω		6R6039		
R18	220KΩ		6R6015		
R19	470Ω		6R6039		
R20	10KΩ		6R6054		
R21	15KΩ		6R6477		

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA MOTOROLA PART No	IRC PART No	NOTES
R22	1000Ω	1	6R6301		
R23	1000Ω	1	6R6301		
R24	2700Ω	1	6R5688		
R25	15KΩ				
R26	1000Ω	1	6R6301		
R27	47Ω	1	6R5550	BTS-47	
R28	1000Ω	1	6R6301	BTS-1000	
R29	15KΩ				
R30	1000Ω	1	6R6301		
R31	47Ω	1	6R5550	BTS-47	
R32	1000Ω	1	6R6301	BTS-1000	
R33	33KΩ		6R6401		
R34	1200		6R5551	BTS-120	
R35	1000Ω	1	6R6301		
R36	1000Ω	1	6R6301		

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS (cont)

ITEM No	RATING OHMS	RATING WATT	REPLACEMENT DATA MOTOROLA PART No	IRC PART No	NOTES
R37	470Ω	1	6R6080		
R38	180KΩ	1	6R6044		
R39	1Meg		6R6046		
R40	180KΩ		6R6044		
R41	5800Ω		6R6117		
R42	18KΩ	1	6R6754		
R43	22KΩ	2	6R6396		
R44	3900Ω	5	17K730466	PWT-3900	
R45	12KΩ		6R6394		
R46	220KΩ				Note 3
R47	100KΩ				Notes 4, 9
R48	2.5Meg		6R3937		
R49	220KΩ		6R6407		Note 5
R50	1200Ω		6R6369	BTS-1200	
R51	150Ω		6R6373	BTS-150	
R52	220Ω		6R6370	BTS-220	
R53	220Ω		6R6370	BTS-220	
R54	330Ω		6R6370	BTS-220	
R55	33KΩ		6R6410	BTS-33K	
R56	22KΩ		6R6397	BTS-22K	
R57	68KΩ		6R6001	BTS-68K	
R58	1500Ω 5%	1	6R600459	BTS-1500 5%	Note 8
R59	332Ω 5%	1	6R5758	BTA-332 5%	
R60	100Ω			BTS-100	Note 6
R61	2.2Meg		6R6497		
R62	1.5Meg		6R3996		
R63	270KΩ		6R6414		
R64	1Meg		6R6046		
R65	560KΩ		6R6097		
R66	332Ω		6R6397		
R67	2200Ω		6R6069		
R68	680Ω		6R6428		
R69	270KΩ		6R6577		
R70	33KΩ		6R6022		
R71	10KΩ		6R6054		
R72	100Ω		6R6018		
R73	820Ω	2	6K120579		
R74	560Ω		6R617		
R75	120Ω		6R6651		
R76	12KΩ	10	17K730388		
R77	100KΩ		6R6031		
R78	33KΩ		6R6397		
R79	100KΩ		6R6031		
R80	100KΩ		6R6031		
R81	4.7Meg		6R3182		
R82	150KΩ	1	6R610053		
R83	150KΩ	1	6R610053		
R84	100Ω		6R6039		
R85	1800Ω		6R617		
R86	82KΩ		6R5644		
R87	68KΩ		6R6074		
R88	47Ω		6K9080		
R89	470Ω		6R6080		Note 7
R90	330KΩ		6R3096		
R91	330Ω	1	6R6354		Note 7
R92	1Ω		6R3031		
R93	3.3Ω		17K485413		
R94	2200 Cold		6R6599		
	18Ω Hot	7	6A720692		
R95	7.5Ω		17A711800		
R96	2.2Meg				Note 9

Note 1. In initial production R25 was 22K and R29 was 47K.
Note 2. Used in production runs before TS-531A-02.
Note 3. Production runs before TS-531A-03 use a 180KΩ resistor in this application.
Note 4. Production runs before TS-531A-03 use a 470KΩ resistor in this application.
Note 5. Not used in production runs TS-531A-04 and later.
Note 6. Used in productions runs TS-531A-03 and later.
Note 7. Production runs TS-531A-04, R89 is 680Ω and R91 is 560Ω.
Note 8. Production run TS-531A-04. R58 is 1800Ω.
Note 9. Not used in some versions.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	REPLACEMENT DATA MOTOROLA PART No	Halldorson PART No	Merit PART No	RCA TYPE No	Ram PART No	Stancor PART No	Thordarson PART No	Triad PART No
T1	Vert. Osc. Trans.	25B730178	B6702	A-3006		V405	A-6125	26A03	A-97X
T2	Horiz. Output Trans.	24K735664 ①		HVO-39 ②		XU18 *	A-8248 *	F1Y-57 *	
		24K736082 ③ ④							
T3	Vert. Output Trans.	25B730145	21805 ⑤ ⑥	A-3081 ⑤ ⑥		V306 ⑤ ⑥	A-8140 ⑤ ⑥	26B57 ⑤ ⑥	A-110X ⑤
		25K721027 ⑦							
T4A	Yoke-Horiz. (24.5MH)	24K732711 ⑧	DF803 ⑧	MDY ⑧	214DI	Y70F25/3	DY-10 ⑧	Y-11 ⑧ ⑨	Y-30-10 ⑧
			⑨ ⑩	⑨ ⑩	⑧ ⑨ ⑩	⑨ ⑩	⑨ ⑩	⑨ ⑩	⑨ ⑩
B	Vert. (2.5MH)	24C733436 ⑪ ⑫							
		24C733411 ⑪ ⑫							
		24C735783 ⑪ ⑫							
		24K732710 ⑪ ⑫							

① Complete assembly. Includes the following items which may be purchased separately: V15, HV Rectifier, primary coil, (Motorola part #24K735960), secondary coil (Motorola part #24K731996).
② Alternate vertical output transformer.
③ Drill new mounting hole(s).
④ Connect as auto transformer.
⑤ Use 50 Ω 1 turns ratio.
⑥ Includes plug (Motorola part #28A732671) . Does not include rear cover and centering device (Motorola part #4SA721145 for all except 24C733436 yoke. Motorola part #4SA733487 for 24C733436 yoke only.
⑦ Alternate deflection yoke.
⑧ Use original rear cover and centering device.
⑨ Jumper terminals #1 and #6.
⑩ Use original yoke damping network.
⑪ Alternate horizontal output transformer.
⑫ Complete assembly. Includes the following items which may be purchased separately: (V16) HV Rectifier primary coil (Motorola part #24K736078) , secondary coil (Motorola part #24K736074).

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type is Listed

ORIGINAL TERMINAL CONNECTIONS	Halldorson Replacement Connections	Merit Replacement Connections	RCA Replacement Connections	Ram Replacement Connections	Stancor Replacement Connections	Thordarson Replacement Connections	Triad Replacement Connections
6	6	6	6	6	6		
4	4	4	5	4	4		
3	3	3	4	3	3		
1	1	1	3, 2, or 1 ⑬	1	1		

⑬ Select tap which gives best performance.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA MOTOROLA PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T5	2.4KΩ	3.2Ω	25K730140	21001	A-3928	A-3676	24S50	S-1X	

SPEAKER

ITEM No.	RATINGS SIZE	RATINGS FIELD	RATINGS V. C. IMP	REPLACEMENT DATA MOTOROLA PART No	QUAM PART No	NOTES
SP1	5 1/4"	87.8Ω	3.2Ω	50C732980 ①	52E858	① Used in models 21T21, Y21T21, 21T21B, Y21T21B, 21T21E, and Y21T21E.
				50C732359 ①		② Used in models 21T22, Y21T22, 21T22B, and Y21T22B.
				50C732987 ②		③ Used in models 21K29, Y21K29, 21K29B, Y21K29B,
				50C732758 ③		21K29W, Y21K29W, 21K30, Y21K30, 21K30B, and Y21K30B.
				50C734178 ③		④ Used in models 21K33E and Y21K33E
				50C734578 ④		
				50C733242 ③		
	6"	85Ω	3.2Ω	50K733122 ③	8E858	
				50K733142 ③		
				50K733243 ③		
				50K733241 ③		
				50K735079 ③		
	T"	88Ω	3.2Ω	50C735696 ④	7E858	
				50C736106 ④		
				50C736113 ④		

COILS (RF-IF)

ITEM No.	USE	DC RES PRI	DC RES SEC	REPLACEMENT DATA MOTOROLA PART No	MEISSNER PART No	MERIT PART No	MILLER PART No	NOTES
L1	VHF Ant. Trans	ODCT		24B735906				
L2	IF Trap	0Ω		24A735855				
L3	UHF IF Input	0Ω		24A735121				
L4	VHF Ant. Coils	0Ω		24K730887				Channels 3 thru 6
L5	VHF Ant. Shunt Coil	0Ω		24B735859				Channel 5
L6	VHF Ant. Coils	0Ω						Channels 7 thru 13
L7	VHF Ant. Shunt Coils	0Ω						Channels 7 thru 13
L8	VHF Ant. Coil	0Ω		24A735860				Channel 13
L9	Fil. Choke	0Ω		24K730391				
L10	Neut. Coil	0Ω		24K731246				
L11	VHF RF Coil	0Ω		24A735856				Channel 13
L12	VHF RF Coils	0Ω		24B735758				
L13	UHF I.F Coil	0Ω						Part of 34B735758
L14	UHF RF Choke	0Ω		24A733652				
L15	UHF RF Choke	0Ω		24A733653				
L16	Fil. Choke	0Ω		24K730391				
L17	VHF Osc. Coil	0Ω		24A735759				Channel 13
L18	VHF Osc. Coils	0Ω		24B730389				
L19	Conv. Plate	.1Ω		24K734308				Core Part No. 76A732345
L20	1st Video IF	0Ω		24A732875	17-4322*	TV-131	6238*	Core Part No. 76A733245
L21	Fil. Choke	0Ω		24K730391	19-1001	TV-189	4604	L 3 Microreries
L22	2nd Video IF	.2Ω	.2Ω	24B735179			6231	Includes 41.25MC Trap Core Part No. 46A732436
L23	3rd Video IF	.1Ω	.1Ω	24B735180			6232	Includes 47. 25MC Trap Core Part No. 46A732435
L24	Fil. Choke	0Ω		24K730391	19-1001	TV-189	4604	L 3 Microreries
L25	RF Choke	0Ω		24A732652				
L26	Series Peaking Coil	1.4Ω		19-1005			4612	8 5 Microreries Note 1
L27	Series Peaking Coil	6.7Ω		24K732807	19-4200	TV-184	6154	200 Microreries, Wound on 10KΩ resistor
L28	Shunt Peaking Coil	8Ω		24K732809	19-3250	TV-185	6130	372 Microreries
L29	Series Peaking Coil	1.9Ω		24R121738	19-1005*		4613*	13 Microreries, wound on 8.2KΩ resistor
L30	4.5MC Trap	2.2Ω		1V730806	20-1004	TV-181	1460	Core Part No. 76A732345
L31	Series Peaking Coil	6.7Ω		24K732808	19-3250*	TV-185*	6181*	234 Microreries, wound on 10KΩ resistor
L32	Shunt Peaking Coil	8.3Ω		24K732806	19-3180	TV-184	6180	182 Microreries
L33	Shunt Peaking Coil	25Ω		24K734187	19-3300		4603*	1 Microhenry, wound on 4.7KΩ resistor
L34	RF Coil	1.4Ω		24K733235	19-1005		4612	10 Microreries
L35	Sound IF	4.4Ω		24K735092	20-1005	TV-151	1470	Core Part No. 76A732345
L36	RF Coil	10.5Ω		24K735172	19-4400		6135	400 Microreries
L37	Ratio Det.	7Ω	1.4ΩCT	24K735697	17-3497	TV-115	6205	Tertiary Winding. 7Ω
L38	Fil. Choke	0Ω		24K730391	19-1001	TV-189	4604	L 3 Microreries
L39	Horiz. Osc.	40Ω		1V732556	19-1570†	TV-183†	6310†	Core Part No. 46A730344
L40	RF Choke	1.8Ω		24A733235	19-1005		4613	10 Microreries
L41	RF Choke	1.8Ω		24A732235	19-1005		4612	10 Microreries

Note 1. Not used in some versions.
* Use one winding only.
■ Deluxe trap.
▲ Parallel with 10KΩ resistor.
◆ Parallel with 8.2KΩ resistor.
▪ Parallel with 4.7KΩ resistor.
† Drill new mounting hole.

SELENIUM RECTIFIER

ITEM No.	RATING CURRENT	REPLACEMENT DATA MOTOROLA PART No.	FEDERAL PART No	INTERNATIONAL PART No	MALLORY PART No	RADIO RECEPTOR PART No	SARKES TARZIAN PART No.	NOTES
M1	.170ADC	48K130023	1090A	MR-300	6S300	6Q4	300	① Alternate Selenium Rect.
		48B720023 ①						
M2	.170ADC	48K130032	1080A	MR-300	6S300	6Q4	300	
		48B720023 ①						

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA MOTOROLA PART No.	SYLVANIA PART No.	NOTES
M3	D64	48C711052*	1N60 or 1N123	Video Det.

* Alternate Part #'s 48K733204, 48K711077, 48K722720, 48K733158, 48K712199.

MOTOROLA MODELS 21K29 B, W, Y21K29, B, W, 21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B (Ch. TS-531A, WTS-5, 5A, 5B, 5C)

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DENVER, COLORADO

TIONS (Continued)

(ont)

RATING OHMS	RATING WATT	REPLACEMENT DATA MOTOROLA PART No.	REPLACEMENT DATA IRC PART No.	NOTES
5800Ω	½	6R6428		
1700Ω	½	6R5577		
12KΩ	½	6R6028		
0KΩ	½	6R6054		
00Ω	½	6R6018		
1200Ω	2	6K120579		
5600Ω	½	6R6117		
20Ω	½	6R5551		
20Ω	10	17K712038		
00KΩ	½	6R6031		
12KΩ	½	6R6397		
00KΩ	½	6R6031		
00KΩ	½	6R6031		
1. 7Meg	½	6R2122		
50KΩ	1	6R410053		
50KΩ	1	6R410053		
1000Ω	½	6R6229		
5600Ω	½	6R6117		
32KΩ	½	6R5644		
88KΩ	½	6R6074		
4700Ω	½	6K6080		
4700Ω	½	6R6080		Note 7
330KΩ	½	6R2096		
330Ω	1	6R6254		Note 7
18Ω	½	6R2031		
3. 3Ω	½	17K485412		
230Ω Cold				
19Ω Hot	7	6A720662		
7. 5Ω		17A711500		
2. 2Meg	½			Note 9

as 47K.

0KΩ resistor in this application.
70KΩ resistor in this application.
1 later.
ter.
and R91 is 5600Ω.

CIRCUITS)

EMENT DATA No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
	V405 X118 *	A-8125 A-8248 *	26A03 FLY-57 *	A-97X
	V306③④	A-8140③④	26S57③④	A-110X④
⑩	Y70F25/3 ⑧⑨⑩	DY-10A ⑧⑨⑩	Y-11 ⑧⑨ ⑩	Y-20-1⑧ ⑨⑩

sed separately: V16, HV Rectifier, primary coil,

r and centering device (Motorola part #48A721145 yoke only.

ased separately: (V16) HV Rectifier t #24K736074).

CONNECTION DATA

Type Is Listed

ent ons	Stancor Replacement Connections	Thordarson Replacement Connections	Triad Replacement Connections
	6	6	
	4	4	
	3	3	
⑬	1	1	

) OUTPUT)

Thordarson PART No.	Triad PART No.	NOTES
24S50	S-1X	

SPEAKER

ITEM No.	RATINGS SIZE	FIELD	V. C. IMP.	REPLACEMENT DATA MOTOROLA PART No.	QUAM PART No.	NOTES
SP1	5 1/4"	87. 8Ω	3. 2Ω	50C732998 ①	52E85S	① Used in models 21T21, Y21T21, 21T21B, Y21T21B, 21T21E, and Y21T21E.
				50C733259 ①		② Used in models 21T22, Y21T22, 21T22B, and Y21T22B.
				50C732997 ①		③ Used in models 21K29, Y21K29, 21K29B, Y21K29B, 21K29W, Y21K29W, 21K30, Y21K30, 21K30B, and Y21K30B.
				50C732758 ①		④ Used in models 21K33E and Y21K33E
				50C734175 ②		
				50C734578 ②		
				50C734913 ②		
	8"	85Ω	3. 2Ω	50K733122 ③	8E85S	
				50K733142 ③		
				50K733242 ③		
				50K733241 ③		
				50K735079 ②		
	7"	85Ω	3. 2Ω	50C735696 ④	7E85S	
				50C736106 ④		
				50C736113 ④		

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA MOTOROLA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	VHF Ant. Trans	0ΩCT		24B735906				
L2	IF Trap	0Ω		24A735655				
L3	UHF IF Input	0Ω		24A735121				
L4	VHF Ant. Coils	0Ω		24K730857				Channels 2 thru 6
L5	VHF Ant. Shunt Coil	0Ω		24B735659				Channel 5
L6	VHF Ant. Coils	0Ω						Channels 7 thru 12
L7	VHF Ant. Shunt Coils	0Ω						Channels 7 thru 12
L8	VHF Ant. Coil	0Ω		24A735660				Channel 13
L9	Fil. Choke	0Ω		24K730391				
L10	Neut. Coil	0Ω		24B721256				
L11	VHF RF Coil	0Ω		24A735656				Channel 13
L12	VHF RF Coils	0Ω		24B735758				
L13	UHF IF Coil	0Ω						Part of 24B735758
L14	UHF RF Choke	0Ω		24A732652				
L15	UHF RF Choke	0Ω		24A732652				
L16	Fil. Choke	0Ω		24K730391				
L17	VHF Osc. Coil	0Ω		24A735759				Channel 13
L18	VHF Osc. Coils	0Ω		24B730839				
L19	Conv. Plate	. 1Ω		24K734308				Core Part No. 76A733245
L20	1st Video IF	0Ω		24K733875	17-4522*	TV-131	6226■	Core Part No. 76A733245
L21	Fil. Choke	0Ω		24K730391	19-1001	TV-189	4604	1. 3 Microhenries
L22	2nd Video IF	. 2Ω	. 2Ω	24B735179			6221	Includes 41. 25MC Trap Core Part No. 46A702436
L23	3rd Video IF	. 1Ω	. 1Ω	24B735180			6223	Includes 47. 25MC Trap Core Part No. 46A702436
L24	Fil. Choke	0Ω		24K730391	19-1001	TV-189	4604	1. 3 Microhenries
L25	RF Choke	0Ω		24A732652				
L26	Series Peaking Coil	1. 4Ω			19-1005		4612	8. 5 Microhenries Note 1
L27	Series Peaking Coil	6. 7Ω		24K732807	19-4200	TV-184▲	6154▲	200 Microhenries, Wound on on 10KΩ resistor
L28	Shunt Peaking Coil	8Ω		24K732809	19-3250	TV-185	6130	272 Microhenries
L29	Series Peaking Coil	1. 9Ω		24R121728	19-1005♦		4612♦	13 Microhenries, wound on 8. 2KΩ resistor
L30	4. 5MC Trap	2. 2Ω		1V730808	20-1004	TV-151	1469	Core Part No. 76A733245
L31	Series Peaking Coil	6. 7Ω		24K732808	19-3250▲	TV-185▲	6181▲	234 Microhenries, wound on 10KΩ resistor
L32	Shunt Peaking Coil	6. 3Ω		24K732806	19-3180	TV-184	6180	182 Microhenries
L33	Shunt Peaking Coil	25Ω		24K734187	19-5100		4652▲	1 Microhenry, wound on 4. 7KΩ resistor
L34	RF Coil	1. 4Ω		24A733225	19-1005		4612	10 Microhenries
L35	Sound IF	4. 4Ω		24K735083	20-1005	TV-151	1470	Core Part No. 76A733245
L36	RF Coil	10. 5Ω		24K735172	19-4400		6136	400 Microhenries
L37	Ratio Det.	7Ω	1. 4ΩCT	24K735697	17-3497	TV-115	6205	Tertiary winding=. 7Ω
L38	Fil. Choke	0Ω		24K730391	19-1001	TV-189	4604	1. 3 Microhenries
L39	Horiz. Osc.	40Ω		1V732556	19-1576†	TV-163†	6210†	Core Part No. 46A780344
L40	RF Choke	1. 6Ω		24A733225	19-1005		4612	10 Microhenries
L41	RF Choke	1. 6Ω		24A733225	19-1005		4612	10 Microhenries

Note 1. Not used in some versions.
* Use one winding only.
■ Detune trap.
▲ Parallel with 10KΩ resistor.
♦ Parallel with 8. 2KΩ resistor.
▬ Parallel with 4. 7KΩ resistor.
† Drill new mounting hole.

SELENIUM RECTIFIER

ITEM No.	RATING CURRENT	REPLACEMENT DATA MOTOROLA PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	NOTES
M1	. 170ADC	48K120023 48B720023 ①	1090A	MR-300	6S300	6Q4	300	① Alternate Selenium Rect.
M2	. 170ADC	48K120023 48B720023 ①	1090A	MR-300	6S300	6Q4	300	

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA MOTOROLA PART No.	SYLVANIA PART No.	NOTES
M3	1N64	48C711052*	1N60 or 1N132	Video Det.

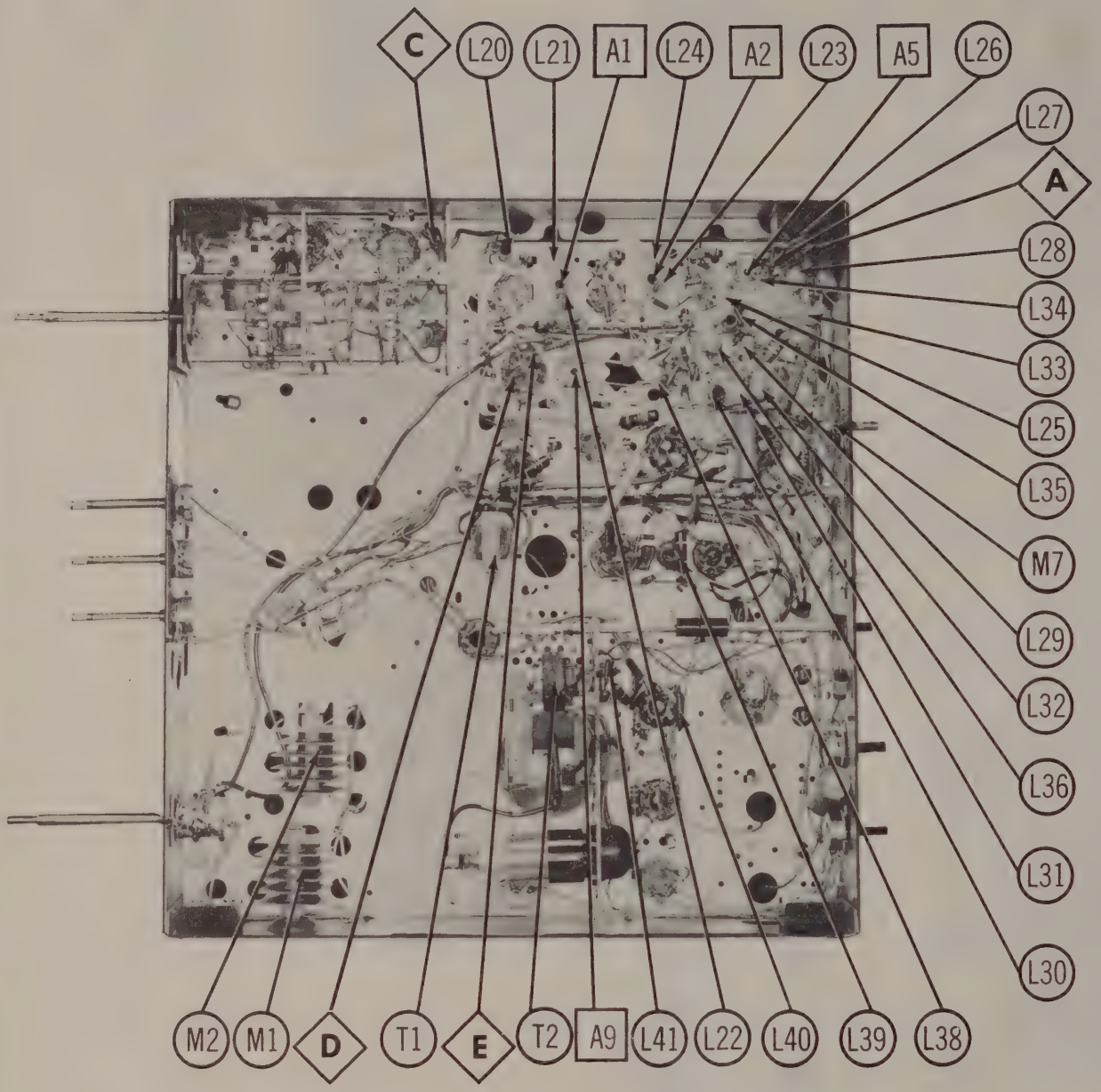
* Alternate Part #'s 48K733204, 48K711077, 48K722720, 48K733158, 48K712199.

MOTOROLA MODELS 21K29, B, W, Y21K29, B, W, 21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B (Ch. TS-531, Y, WTS-531, Y)

PARTS LIST AND DESCRIPTIONS (Continued)

MISCELLANEOUS

ITEM No.	PART NAME	MOTOROLA PART No.	NOTES
M4	Tuner	1U735114	VHF - Chassis TS-531, WTS-531
	Tuner	1U735118	VHF - Chassis TS-531Y, WTS-531Y
M5	Tuner	VTT-37	UHF - Chassis TS-531Y, WTS-531Y
M6	Video Det. Assy.	24C735329	Includes M3, coils and capacitors
M7	Switch		Area Selector
M8	Centering Device	48A721145	Includes deflection yoke rear cover - For all deflection yokes, except yoke part #24C733436
	Centering Device	48A733487	Includes deflection yoke rear cover - For yoke part #24C733436 only
M9	Ion Trap	59K734028	
	Cabinet	16K735156	Models 21K29, Y21K29
	Cabinet	16K735157	Models 21K29B, Y21K29B
	Cabinet	16K735598	Models 21K29W, Y21K29W
	Cabinet	16F735158	Models 21K30, Y21K30
	Cabinet	16K735159	Models 21K30B, Y21K30B
	Cabinet	16K735332	Models 21T21B, Y21T21B
	Cabinet	16K735333	Models 21T21E, Y21T21E
	Cabinet	16E735161	Models 21T22, Y21T22
	Cabinet	16K735162	Models 21T22B, Y21T22B
	Cabinet	16K735986	Models 21K30W, Y21K30W
	Cabinet	16F736034	Models 21K33E, Y21K33E
	Knob	36K735381	VHF channel selector - Models 21K29, 21K29B, 21K29W, 21K30, 21K30B, 21T21B, 21T22, 21T22B
	Knob	36K735383	VHF Channel selector - Models 21T21E, 21K33E
	Knob	36C735380	VHF channel selector - Models Y21K29, Y21K29B, Y21K29W, Y21K30, Y21K30B, Y21T21B, Y21T22, Y21T22B
	Knob	36K735382	VHF channel selector - Models Y21T21E, Y21K33E
	Knob	36C735384	Fine tuning & on-off-volume - Models 21K29, 21K29B, 21K29W, Y21K29, Y21K29B, Y21K29W, 21K30, 21K30B, Y21K30, Y21K30B, 21T21B, Y21T21B, 21T22, 21T22B, Y21T22, Y21T22B
	Knob	36K735385	Fine tuning & on-off-volume - Models 21T21E, Y21T21E Y21K33E, Y21K33E
	Knob	36C735378	Contrast - Models 21K29, 21K29B, 21K29W, Y21K29, Y21K29B, Y21K29W, 21K30, 21K30B, Y21K30, Y21K30B, 21T21B, Y21T21B, 21T22, 21T22B, Y21T22, Y21T22B
	Knob	36K735379	Contrast - Models 21T21E, Y21T21E, 21K33E, Y21K33E
	Knob	36B712294	Area Selector Switch - All models
	Knob	36B733492	Horiz.,Vert. & Brightness - Models 21K29, 21K29B, 21K29W, Y21K29, Y21K29B, Y21K29W, 21K30, 21K30B, Y21K30, Y21K30B, 21T21B, Y21T21B, 21T22, 21T22B, Y21T22, Y21T22B
	Knob	36K735294	Horiz, Vert. & Brightness - Models 21T21E, Y21T21E
	Scale	34C735386	UHF channel selector - Models Y21K29, Y21K29B, Y21K29W, Y21K30, Y21K30B, Y21T21B, Y21T21E, Y21T22, Y21T22B
	Safety Glass	61K732778	Models 21K29, 21K29B, 21K29W, Y21K29, Y21K29B, Y21K29W
	Safety Glass	61K734345	Models 21K30, 21K30B, Y21K30, Y21K30B, 21T22, 21T22B, Y21T22, Y21T22B
	Safety Glass	61K733388	Models 21T21B, 21T21E, Y21T21B, Y21T21E
	Mask	13D735047	All models



CHASSIS BOTTOM VIEW-TRANS., INDUCTOR AND ALIGNMENT IDENTIFICATION

TROUBLE SHOOTING AIDS (cont)

...RY OF
...ENSHIP
3824 MEADE ST.
DENVER, COLORADO

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V10, V13, V14, V15 and V16. Check waveform W14.

If Satisfactory	If Unsatisfactory
Check T2, T4A, C88, R91 and other associated components.	Check L39, C82, C83, C84, C86, R84, R85, R87, R88 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V10, V14 and V15. Check M1 and M2. Check R95, R91, C1, C86, C85, T2 and other associated components.

BLOOMING

Check by substitution V10, V14, V15 and V16. Check C1, C85, C86, R91, R89, R95, R94 and other associated components.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video."

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or no Sound."

RASTER, NO SOUND, NO PICTURE

Check by substitution V1, V2, V3, V4, V5, V6 and V10. Check video IF components for failure or change of value.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set."

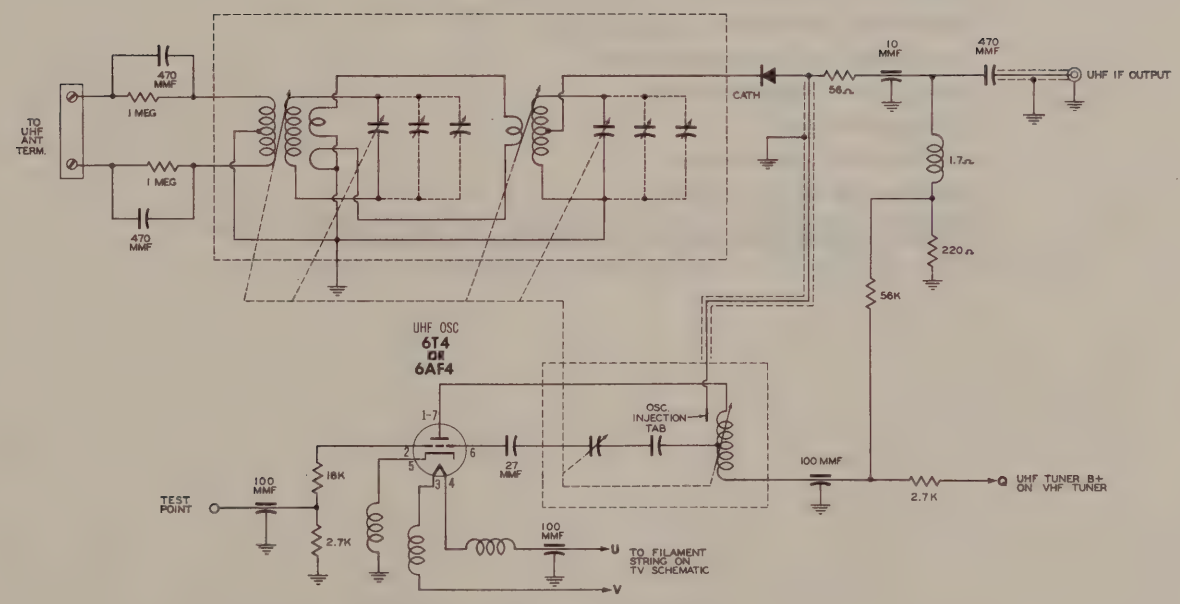
KEYSTONE EFFECT

Check T4 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



UHF TUNER WTT37 USED ON CHASSIS TS-531Y AND WTS-531Y

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UHF TUNER SCHEMATIC

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

For touch-up adjustment of VHF tuner oscillator adjustments, it is necessary to remove the chassis from the cabinet. (See disassembly instructions).

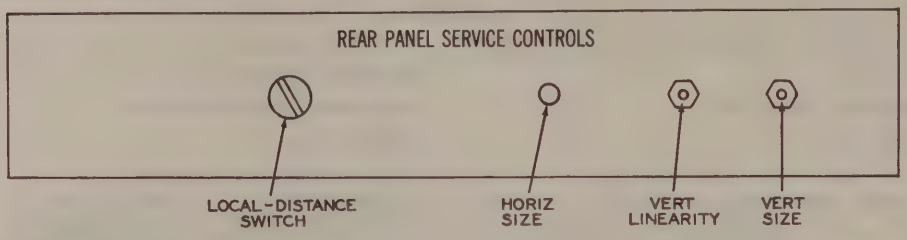
PICTURE TUBE SAFETY GLASS CLEANING

To clean safety glass, remove 4 metal screws holding metal strip at the top of the safety glass. Remove metal strip and safety glass. Use extreme caution when removing safety glass.

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION



HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

To adjust the horizontal oscillator, it is necessary to remove the rear cover and supply power to set. Adjustment is located on top of chassis. Set the horizontal hold control at the center of its range and adjust the horizontal oscillator coil (L39) slug until picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the ratio detector secondary (L37) located on top of chassis. (See tube placement chart).

CENTERING

Centering is accomplished mechanically by adjusting two magnetic rings around the neck of the picture tube, located flush against the deflection yoke. Rotate the two rings around the neck of the tube until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

CHASSIS REMOVAL

1. Remove 7 push-on type control knobs from front panel of cabinet.
2. Remove 1 metal screw. Remove rear cover by unclipping.
3. Remove 2 metal screws. Remove antenna bracket.
4. Remove clip-on resistor fastened to cabinet.
5. Disconnect speaker plug.
6. Remove 4 chassis bolts. Remove chassis.
7. Remove 4 speaker nuts. Remove speaker.

NOTE: If it is necessary to remove the chassis for servicing, it is also necessary to remove the speaker. The speaker is the electro-magnetic type and must be connected for proper operation.

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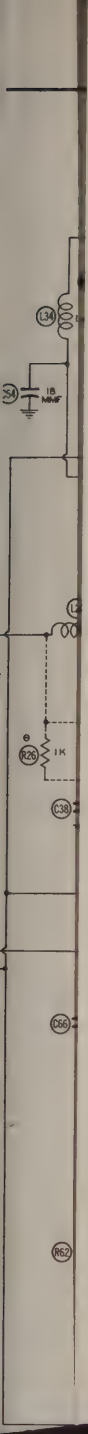
L. F. PLANT
OF



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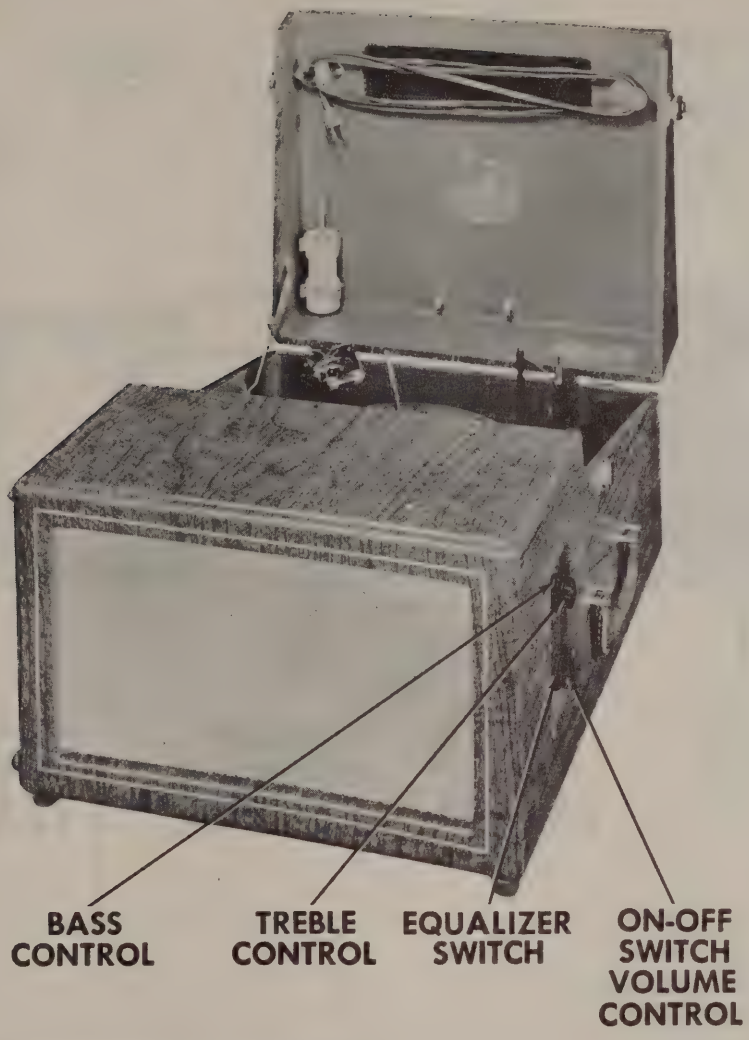
3924 MERDE ST.
DES [illegible] COLORADO

PILOT
MODELS PT-1010, PT-1020



PILOT
MODELS PT-1010, PT-1020

TRADE NAME	Pilot Models PT-1010, PT-1020 "Encore"
MANUFACTURER	Pilot Radio Corp., 37-06 36th St., Long Island City 1, N. Y.
TYPE SET	AC Operated 8 Watt Phono Amplifier With 3 Speed Automatic Record Player
TUBES (Six)	Types 12AX7 Preamp., 12AX7 AF Amp., 12AX7 AF Amp. -Phase Inv., (2) 6V6GT Output, 5Y3GT Rectifier
POWER SUPPLY	105-120 Volts AC-60 Cycles
RATING	.7 Amp. @ 117 Volts AC

FOR SERVICE INFORMATION ON RECORD CHANGER UNIT-GARRARD MODEL RC-80-SEE PHOTOFACT SET #157-FOLDER #5 OR RECORD CHANGER MANUAL CM-4.

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PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		PILOT PART No.	STANDARD REPLACEMENT		
V1	Phono Preamp.	12AX7	12AX7	9A	
V2	AF Amp.	12AX7	12AX7	9A	
V3	AF Amp. - Phase Inv.	12AX7	12AX7	9A	
V4	Audio Output	6V6GT	6V6GT	7S	
V5	Audio Output	6V6GT	6V6GT	7S	
V6	Rectifier	5Y3GT	5Y3GT	5T	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	PILOT PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1A	▲20	450		FP448	TM-4132	T-150	
B	■60	450				MTD-4520	
C	▲20	450					
D	20	450					
C2A	■10	400			TM-4020-450	T-710	
B	▲40	400			TD-250-50	MT-15150	
C	▲200	50					

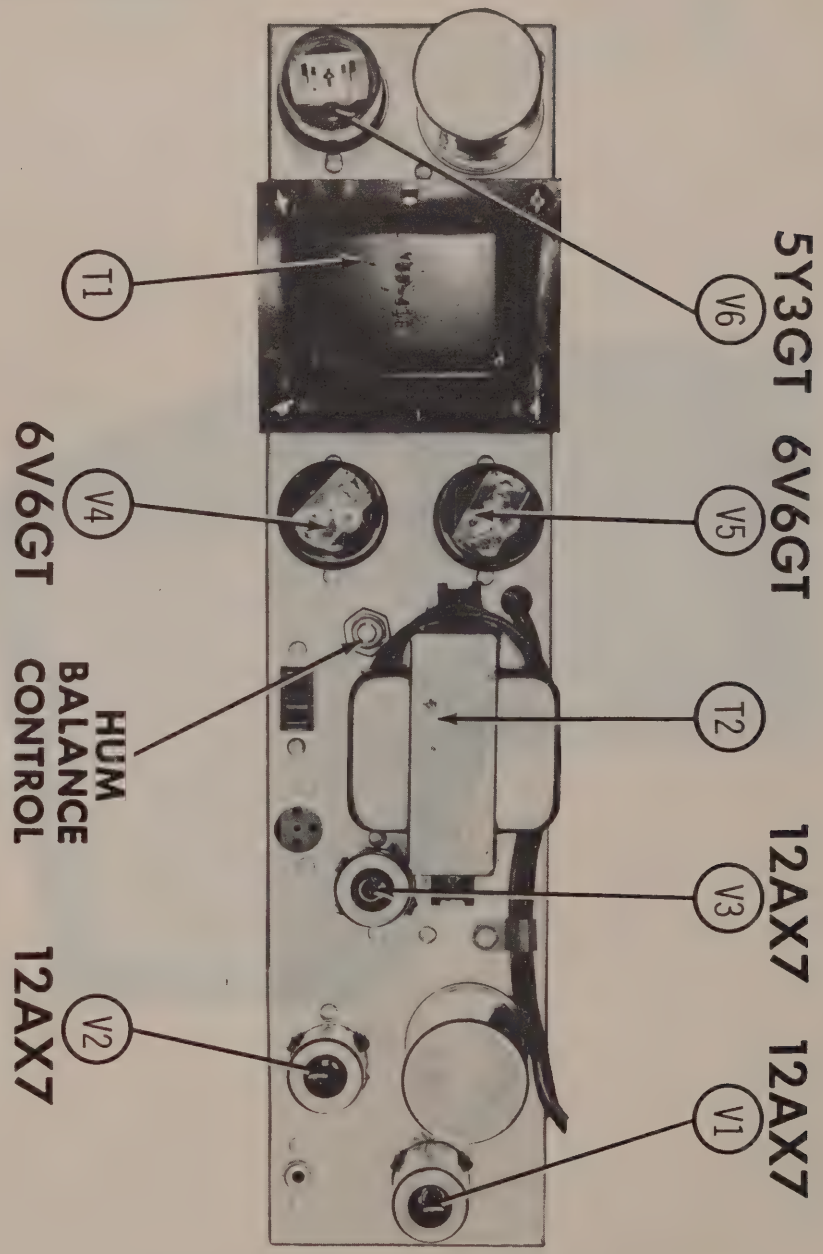
FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	PILOT PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	
C3	.02	400		DF-203	817-02	PT412	
C4	.01	400		D6-103	GP3-333-103	PT411	
C5	800						
C6	.0051	400					
C7	.033	400					
C8	.022	400					
C9	.01	400		D6-103	GP3-333-103	PT411	
C10	30			TCZ-30	831-300		
C11	.022	400					
C12	.047	400		DF-503		PT4147	
C13	50			D6-500	831-500	ZT-545	
C14	1000				811-102	MCB255	
C15	6.8			TCZ-6R8	NPOA-6R8	ZT-5568	
C16	1200				811-122		
C17	.047	400					
C18	.01	400		D6-103	GP3-333-103	PT411	
C19	.1	600		DF-104		PT601	
C20	.1	600		DF-104		PT601	
C21	2	150					
C22	.01	600		D6-103	GP3-333-103	PT411	
C23	.033	400					Note 1

Note 1. Not used in some versions.

CHASSIS—TOP VIEW



CHASSIS—BOTTOM VIEW

PARTS LIST AND ...ONS (Continued)

ITEM No.	RATING RESISTANCE	RATING WATTS	PILOT PART No.	PA	MALLORY PART No.	INSTALLATION NOTES
R1A	Switch		100-95			Equalizer Switch (Panel)
B	1Meg	1				Volume & Switch (Rear) Tapped at 330KΩ.
R2A	5Meg	1	37-28	QJ		Bass (Panel)
B	5Meg	1				Treble (Rear)
R3A	25KΩ	1	39-33A	QU	SU-29	Hum Balance
B				BQ		Attach to R1A

THE COOPERATION OF THE MANUFACTURER OF THIS EQUIPMENT MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AX7	†125KΩ	680KΩ	0Ω	39. 2KΩ	39. 2KΩ	†147KΩ	■190KΩ	3. 3KΩ	39. 2KΩ
V 2	12AX7	†124KΩ	104KΩ	2. 2KΩ	39. 2KΩ	39. 2KΩ	†124KΩ	0Ω	2. 2KΩ	39. 2KΩ
V 3	12AX7	†115KΩ	680KΩ	1. 5KΩ	39.2KΩ	39. 2KΩ	†115KΩ	12KΩ	1. 5KΩ	39. 2KΩ
V 4	6V6GT	TP	39. 2KΩ	†500Ω	†5. 7KΩ	282KΩ	TP	39. 2KΩ	250Ω	
V 5	6V6GT	NC	39. 2KΩ	†500Ω	†5. 7KΩ	270KΩ	NC	39. 2KΩ	250Ω	
V 6	5Y3GT	NC	80KΩ	NC	90Ω	NC	90Ω	NC	80KΩ	

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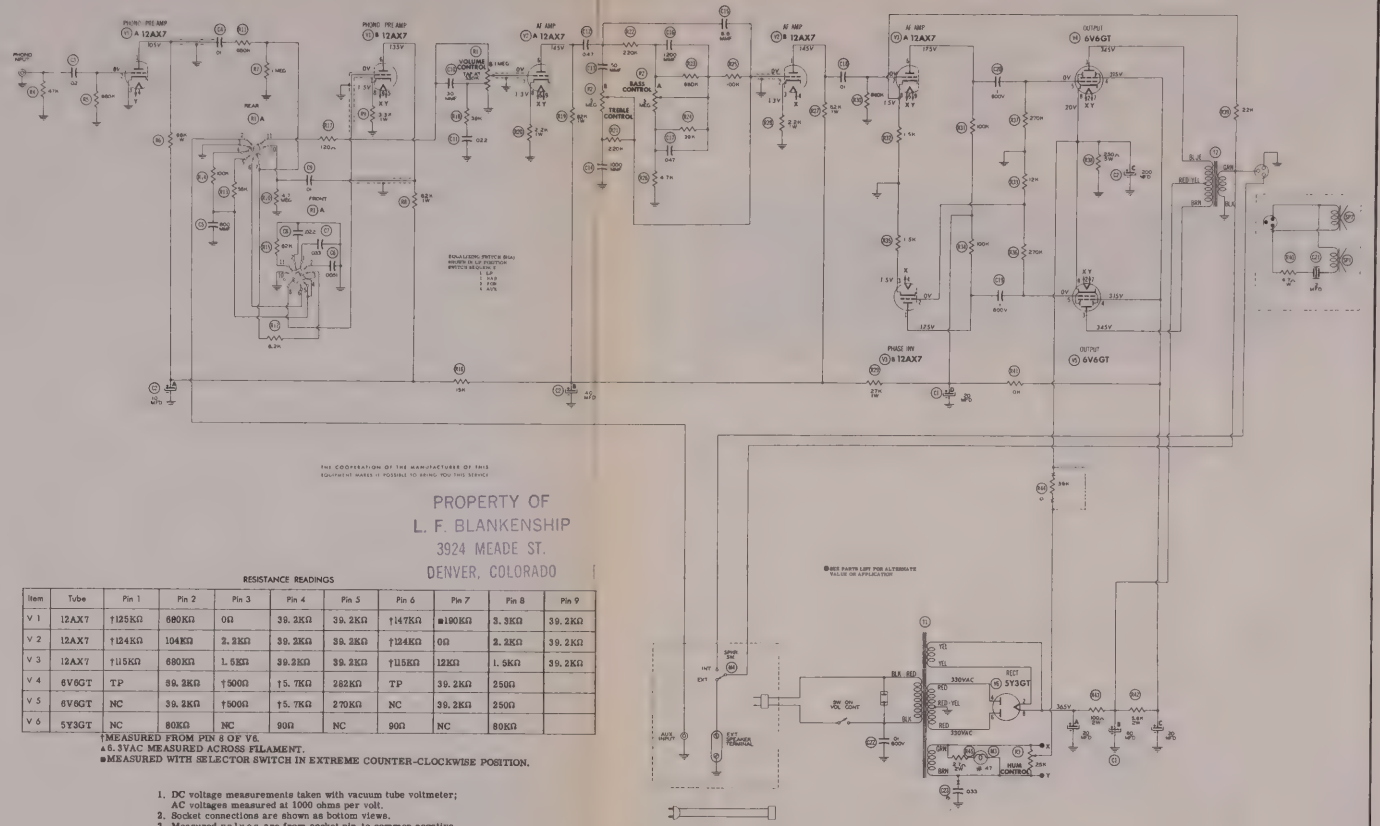

THE COOPERATION OF THE MANUFACTURER OF THIS EQUIPMENT MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AX7	†125KΩ	680KΩ	0Ω	39. 2KΩ	39. 2KΩ	†147KΩ	■190KΩ	3. 3KΩ	39. 2KΩ
V 2	12AX7	†134KΩ	104KΩ	2. 2KΩ	39. 2KΩ	39. 2KΩ	†134KΩ	0Ω	2. 2KΩ	39. 2KΩ
V 3	12AX7	†115KΩ	680KΩ	1. 5KΩ	39. 2KΩ	39. 2KΩ	†115KΩ	12KΩ	1. 5KΩ	39. 2KΩ
V 4	6V6GT	TP	39. 2KΩ	†500Ω	†5. 7KΩ	282KΩ	TP	39. 2KΩ	250Ω	
V 5	6V6GT	NC	39. 2KΩ	†500Ω	†5. 7KΩ	270KΩ	NC	39. 2KΩ	250Ω	
V 6	5Y3GT	NC	80KΩ	NC	90Ω	NC	90Ω	NC	80KΩ	

†MEASURED FROM PIN 8 OF V6.
▲6. 3VAC MEASURED ACROSS FILAMENT.
■MEASURED WITH SELECTOR SWITCH IN EXTREME COUNTER-CLOCKWISE POSITION.

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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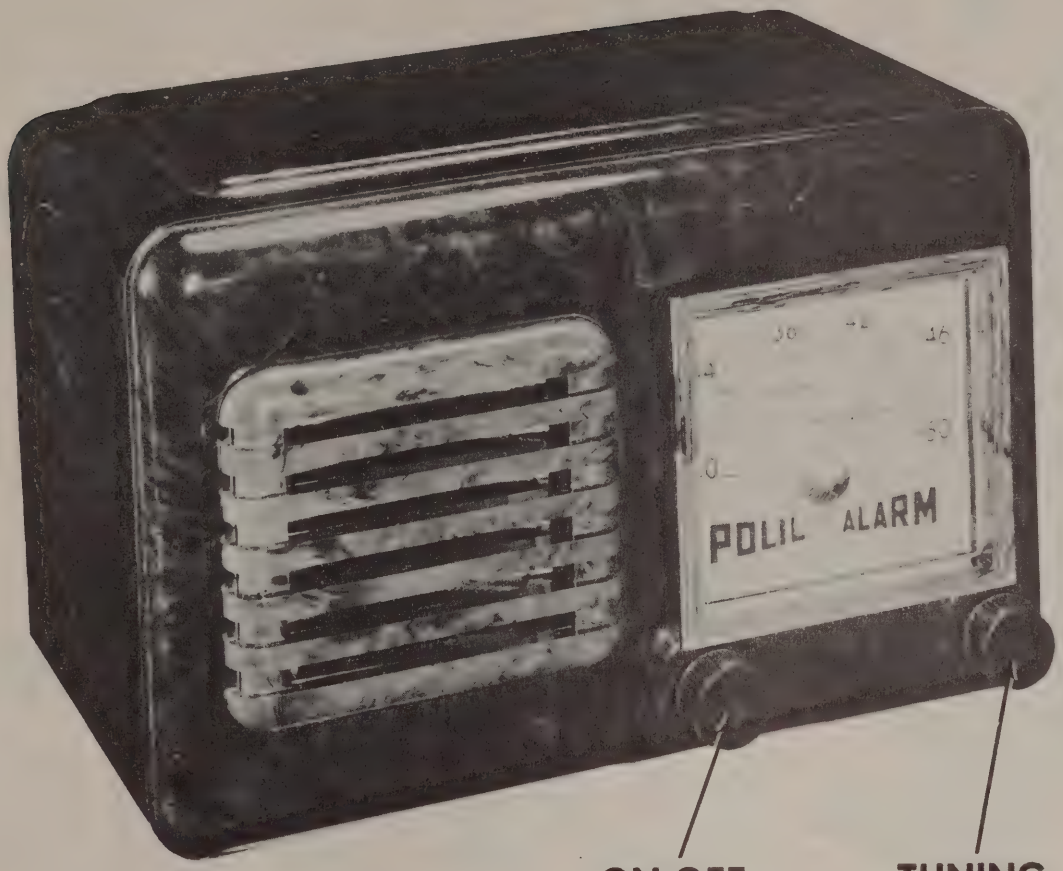
POLICALARM
MODEL PR-31A



PROPERTY OF
L. F. KLAMMSHIP
3924 MEADE ST.
DENVER, COLORADO

POLICALARM
MODEL PR-31A

TRADE NAME	Policalarm Model PR-31A
MANUFACTURER	Monitoradio, Div. I.D.E.A., 7900 Pendleton Pike, Indianapolis, Ind.
TYPE SET	AC-DC Operated FM Superheterodyne Receiver
TUBES (Six)	Types 12AT7 Mixer-Osc., 6BJ6 1st. IF Amp., 6BJ6 2nd. IF Amp., 19T8 Ratio Det.-AF Amp., 35C5 Output, 35W4 Rectifier
POWER SUPPLY	110-120 Volts AC-DC RATING .26 Amp. @ 117 Volts AC
TUNING RANGE	FM 30MC-50MC

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PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		Policalarm PART No.	STANDARD REPLACEMENT		
V1	Mixer-Osc.	12AT7	12AT7	9A	
V2	1st IF Amp.	6BJ6	6BJ6	7CM	
V3	2nd IF Amp.	6BJ6	6BJ6	7CM	
V4	Ratio Det. - AF Amp.	19T8	19T8	9E	
V5	Output	35C5	35C5	7CV	
V6	Rect.	35W4	35W4	5BQ	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	Policalarm PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1A	50	150	300-061-2	TCT-3107	TDL-532	FMT-327	
B	30	150					
C	20	25					
C2	2	75	300-109-1	TC40	TD-4-150	FM-1504	

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

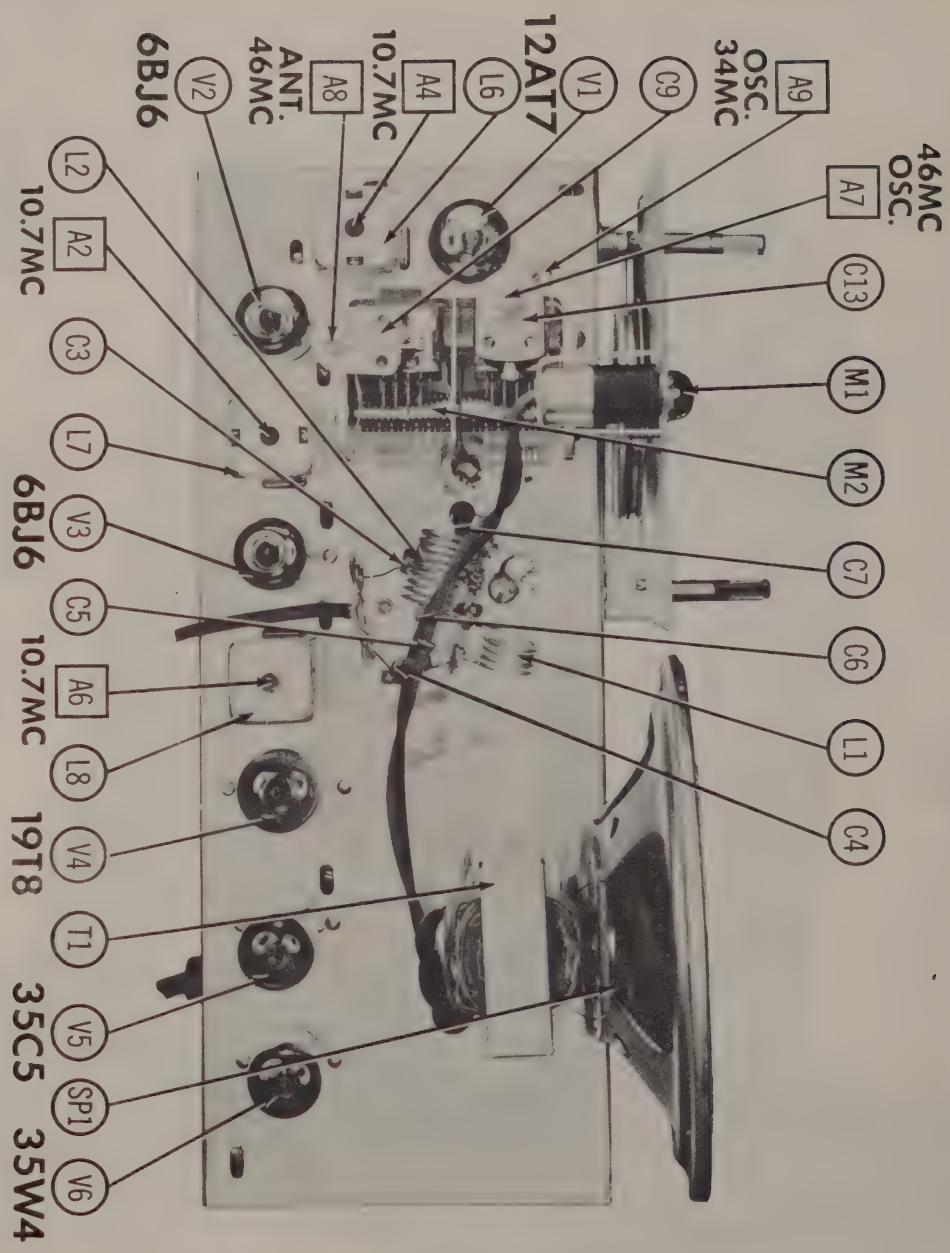
ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	Policalarm PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	
C3	5000		JCD-C4	D6-502	GP2-333-502	UC-525	
C4	270			D6-271	GP2K-271	UC-5327	
C5	30			TCZ-30	NPOL-300		
C6	75			TCZ-75	NPO-335-750	ZT-5475	
C7	75			TCZ-75	NPO-335-750	ZT-5475	
C8	30			TCZ-30	NPOL-300		
C9	5-20		820-B	820-B	557-5		
C10	5000		JCD-C4	D6-502	GP2-333-502	UC-525	
C11	27	500	PQ	TCZ-27	NPOL-270		
C12	150	500		TCZ-150	NPO-335-151	MC236	Note 1
C13	5-20			820-B	557-5		
C14	4.7			TCZ-4R7	NPOA-4R7	ZT-5547	
C15	5000		JCD-C4	D6-502	GP2-333-502	UC-525	
C16	5000		JCD-C4	D6-502	GP2-333-502	UC-525	
C17	.5			TCZ-R5	NPO-0R5		Note 2
C18	5000		JCD-C4	D6-502	GP2-333-502	UC-525	
C19	5000		JCD-C4	D6-502	GP2-333-502	UC-525	
C20	10000		JCD-D7	DD-103	811-01	DC511	
C21	5000		JCD-C4	D6-502	GP2-333-502	UC-525	
C22	100	500		TCZ-100	NPO-337-101	MC235	
C23	100	500		TCZ-100	NPO-337-101	MC235	
C24	1000		JCD-A2	D6-102	GP2L-102	UC-531	
C25	.01	400		D6-103	GP3-333-103	PT411	
C26	470			D6-471	GP2K-471	UC5347	
C27	10000			D6-103	GP3-333-103	DC511	
C28	.01	400		D6-103	GP3-333-103	PT411	
C29	270			D6-271	GP2K-271	UC-5327	
C30	270			D6-271	GP2K-271	UC-5327	Note 2
C31	10000		JCD-D7	DD-103	811-01	DC511	
C32	5000		JCD-C4	D6-502	GP2-333-502	UC-525	
C33	270			DD-271	GP2K-271	UC-5327	

Note 1. Some versions may use a 240MMF capacitor in this application.
Note 2. Not used in some versions.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Policalarm PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	1Meg	½	100-093-4	Q13-137	A47-1Meg-Z	AB-70	U-53	Volume
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R1A.
C	Switch		Not Req.	76-1	SWE-12	KB-1	US-26	Attach to R1A.

CHASSIS—TOP VIEW



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CHASSIS—BOTTOM VIEW

PARTS LIST AND DESC (continued)

RESIS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Policalarm PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R2	68Ω			BTS-68	
R3	10KΩ			BTS-10K	
R4	1000Ω			BTS-1000	
R5	1000Ω			BTS-1000	
R6	470Ω			BTS-470	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Policalarm PART No.	REPLACEMENT DATA IRC PART No.	NOTES
				BTS-47K	
				BTS-10Meg	
				BTS-47K	
				BTS-470K	
				BTS-220K	

FMIF=10.7MC

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1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.

RESISTANCE READINGS

	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
			0Ω	↑2KΩ	68Ω	1KΩ	6Ω
			↑1KΩ	↑1.4KΩ	0Ω		
					0Ω		
						10Meg	↑221KΩ

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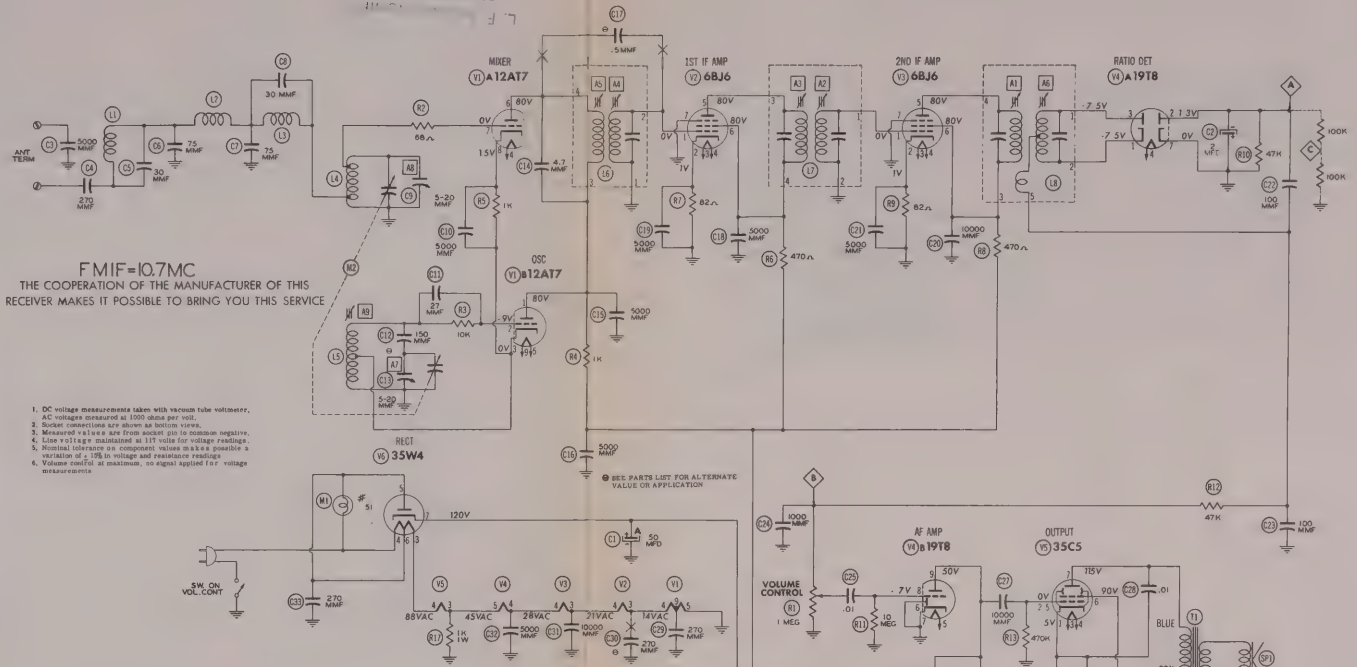

1. DC voltage measurements taken with vacuum tube voltmeter, AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 10% in voltage and resistance readings
6. Volume control at maximum, no signal applied for voltage measurements

● SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AT7	12KΩ	10KΩ	0Ω	12Ω	0Ω	12KΩ	68Ω	1KΩ	6Ω
V 2	6BJ8	8Ω	82Ω	13Ω	18Ω	1L 4KΩ	1L 4KΩ	0Ω		
V 3	6BJ6	6Ω	82Ω	16Ω	24Ω	1L 4KΩ	1L 4KΩ	0Ω		
V 4	19T8	1Meg	47KΩ	1Meg	24Ω	43Ω	0Ω	0Ω	10Meg	1321KΩ
V 5	35C5	150Ω	470KΩ	43Ω	83Ω	470KΩ	71KΩ	1130Ω		
V 6	35W4	TP	NC	83Ω	130Ω	113Ω	113Ω	80KΩ		

*MEASURED FROM PIN 7 OF V6.
TP-TIE POINT.
NC-NO CONNECTION.

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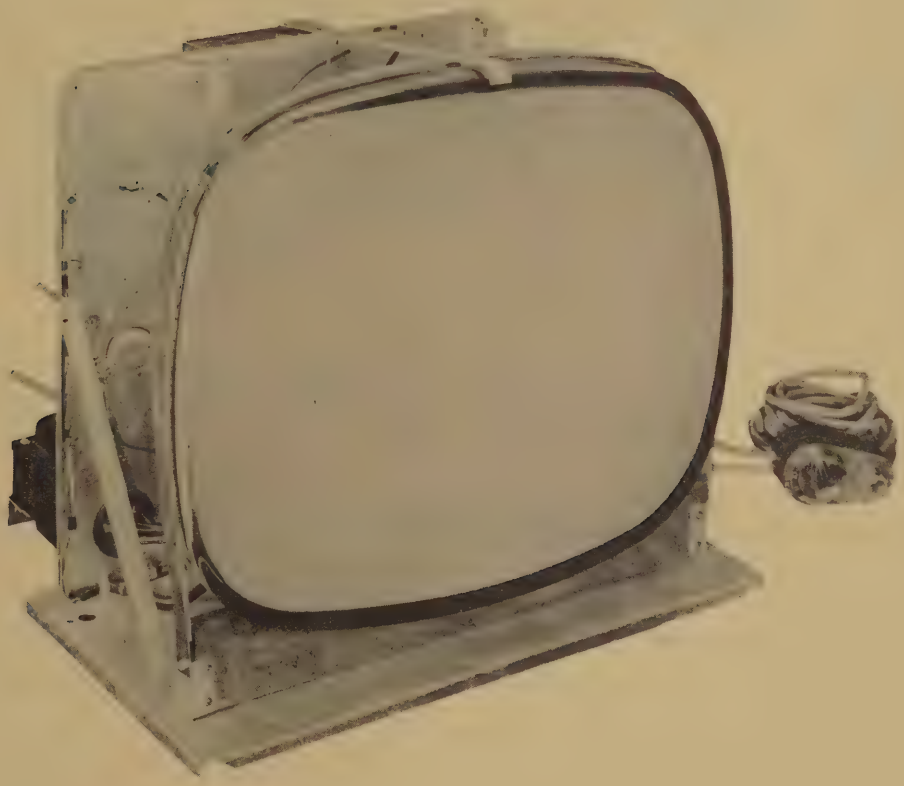

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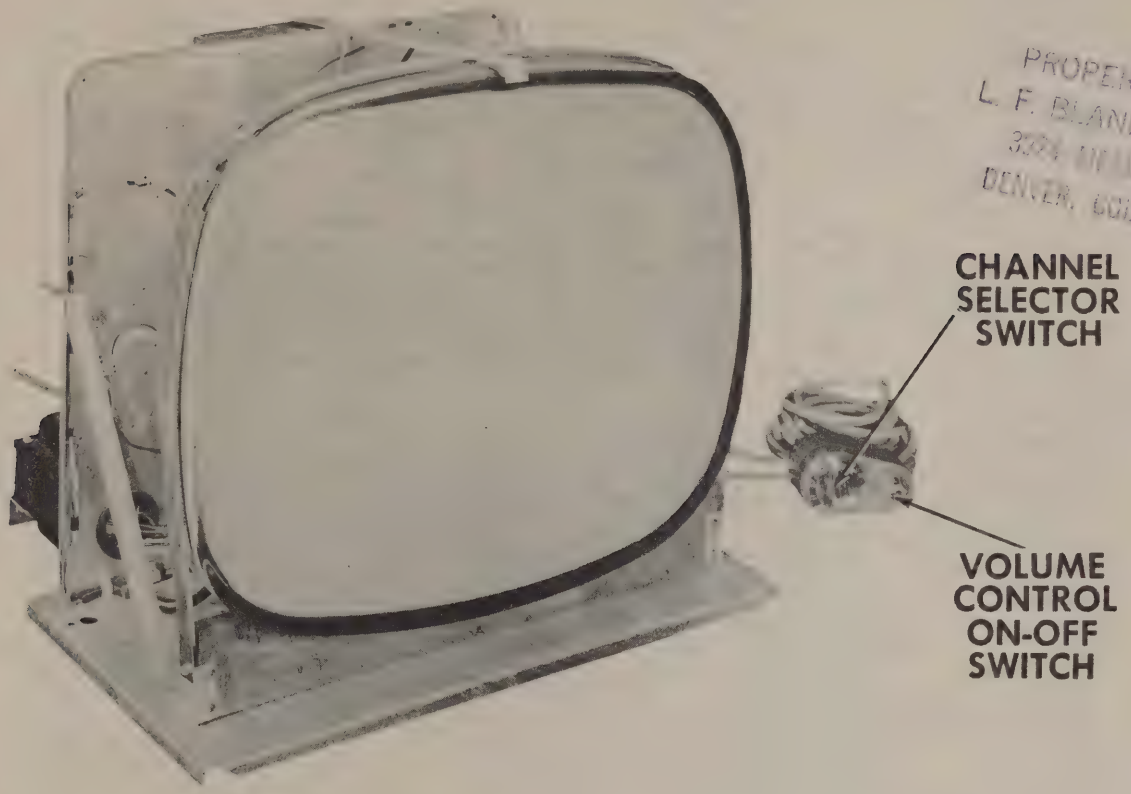

WALSCO
MODEL PC-9

TRADE NAME	Walsco Model PC-9
MANUFACTURER	Walsco Electronics Corp., 3225 Exposition Place, Los Angeles, California
TYPE SET	Television Receiver
TUBES	Twenty-six

POWER SUPPLY 110-120 Volts AC-60 Cycles RATING 1.76 Amp. @ 117 Volts AC
TUNING RANGE Channels 2 thru 13, Video IF 45.75MC, Sound IF 41.25MC (Intercarrier)

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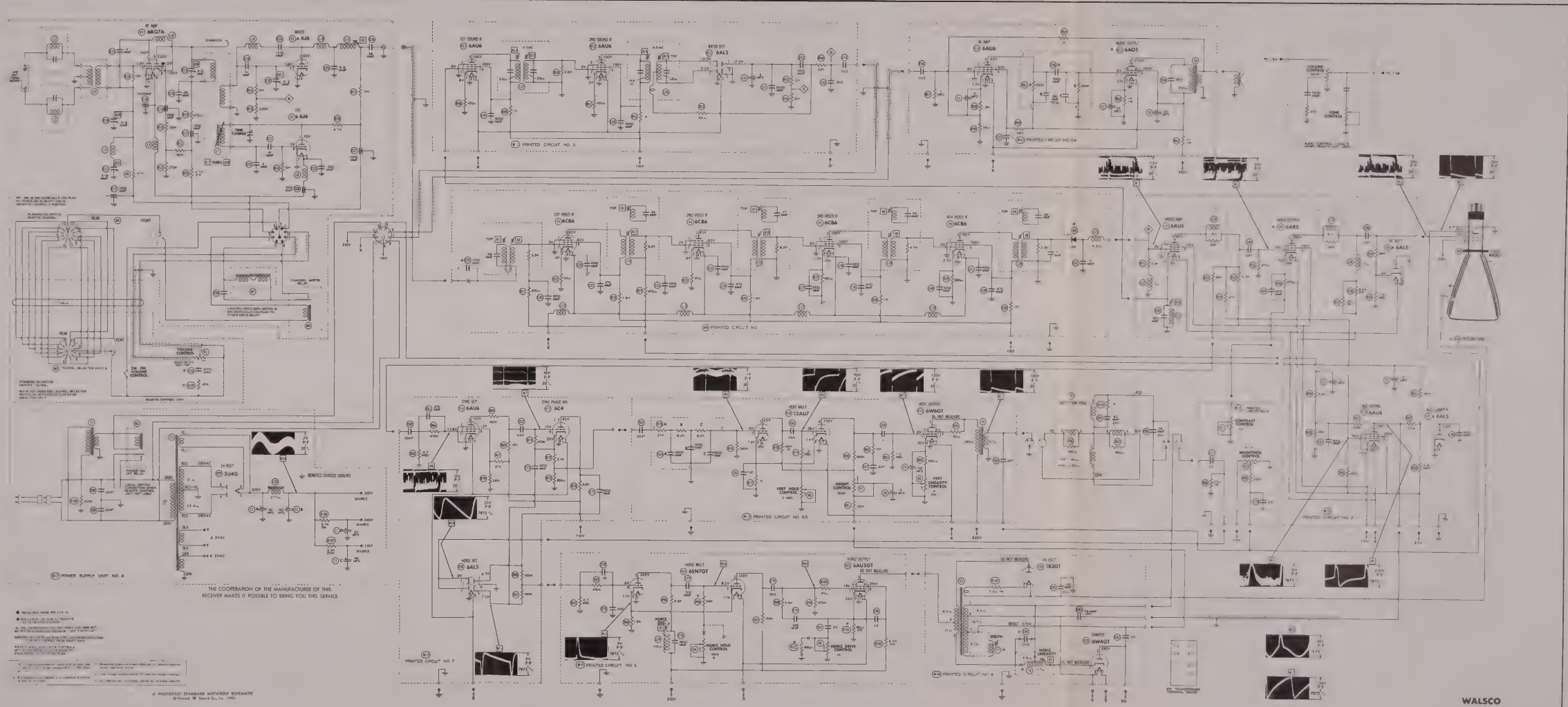
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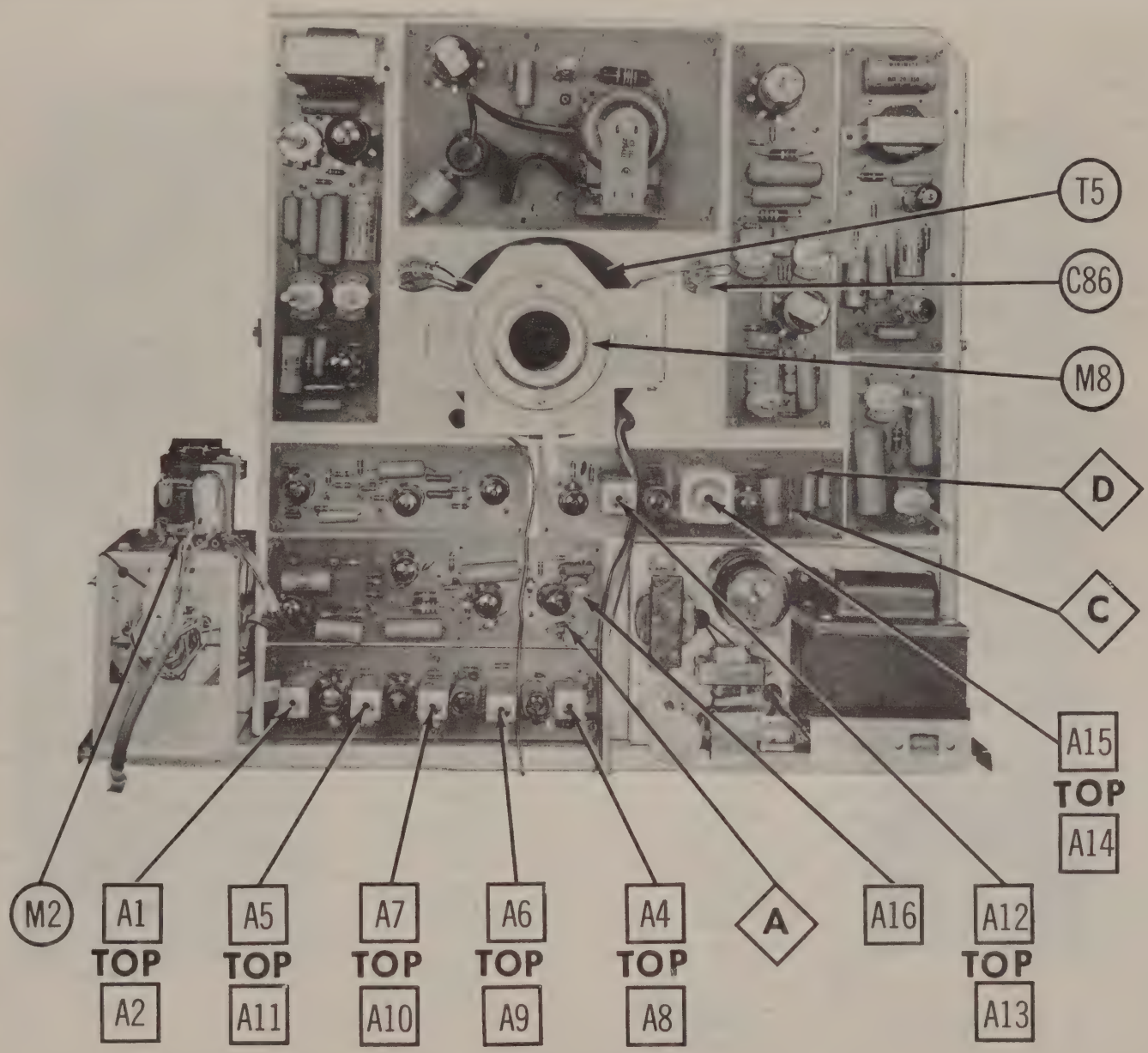

CHASSIS TOP VIEW

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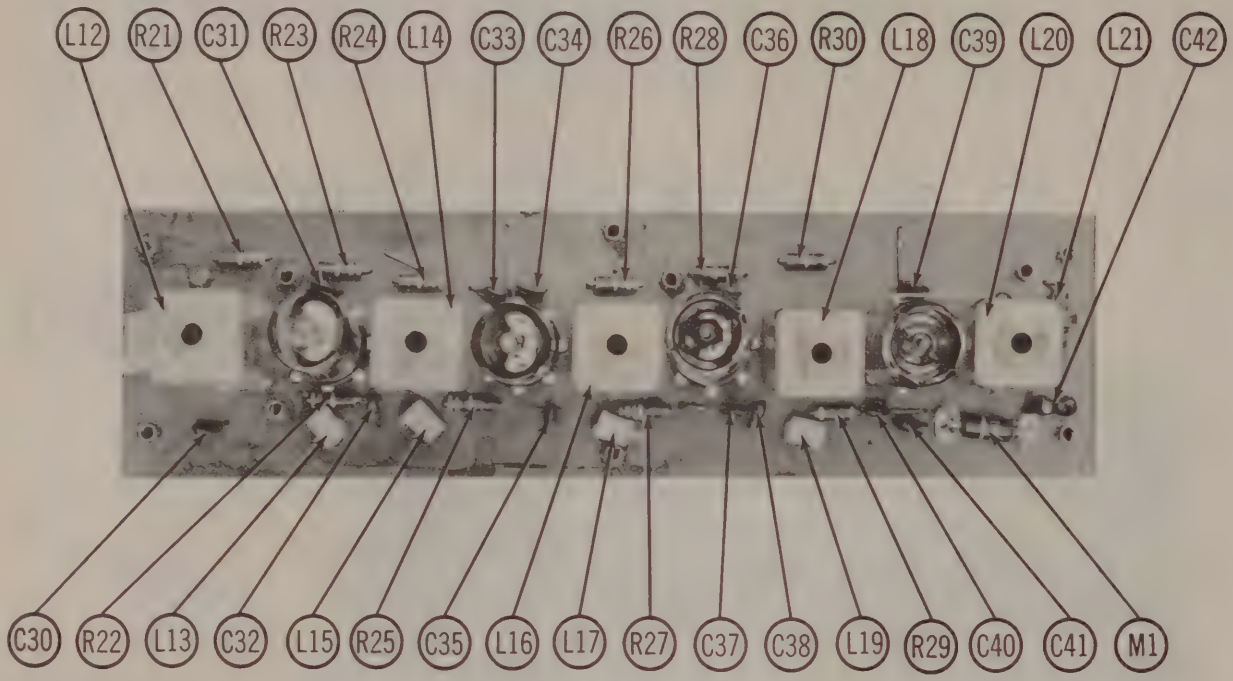
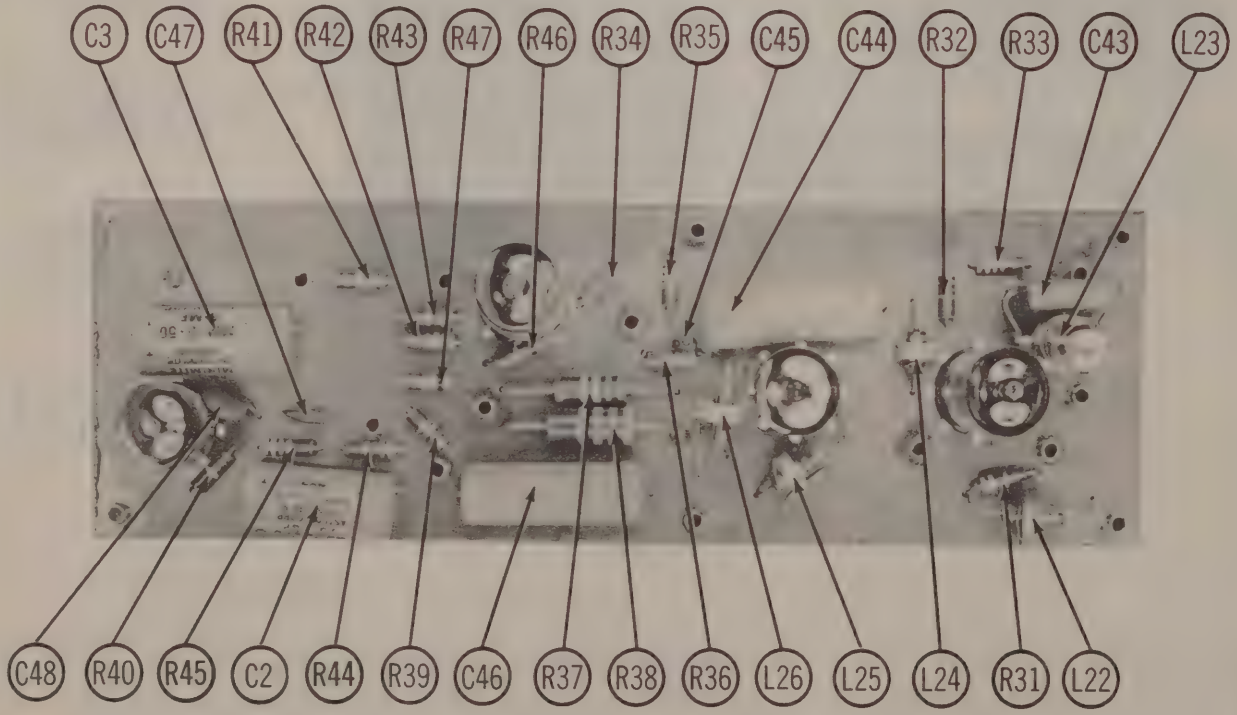


SUB-CHASSIS #1 VIDEO IF UNIT



SUB-CHASSIS #2 VIDEO OUTPUT UNIT

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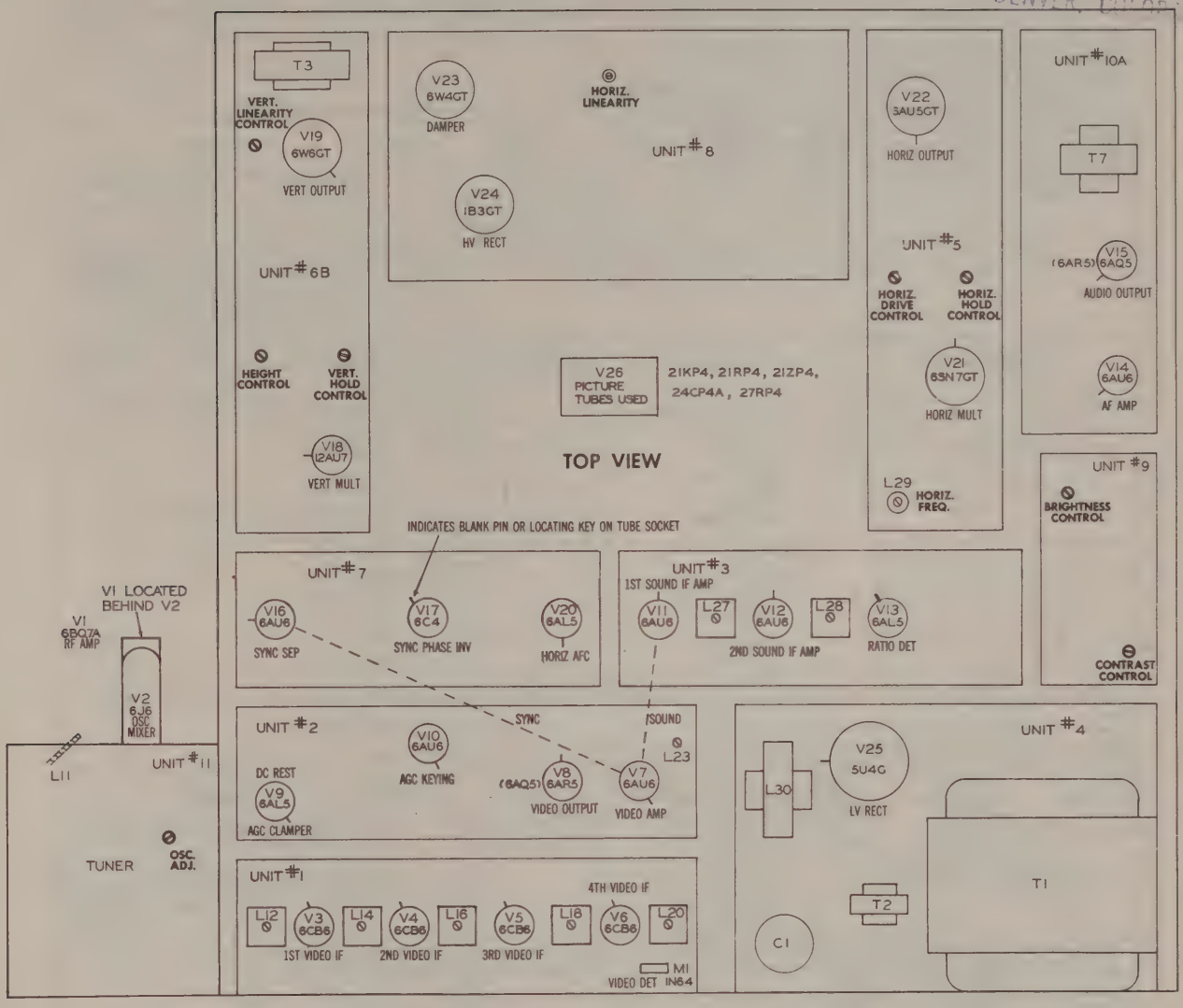
TUBE PLACEMENT CHART



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TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

POWER SUPPLY FAILURE
No raster, no sound - V25

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V2, V3, V4, V5, V6
No pic, no sound, has snow - V1, V2, V3
No pic, has sound, has raster - V7, V8, V9, V10, V26
Has pic, no sound - V11, V12, V13, V14, V15
Overloaded picture - V10

SYNC FAILURE
No vert. sync - V17, V18
No horiz. sync - V17, V20, V21
No vert. or horiz. sync - V16, V17

SWEEP FAILURE
No raster, has sound - V21, V22, V23, V24, V26
No vertical deflection - V18, V19
Poor vert. linearity or foldover - V18, V19
Poor horiz. linearity or foldover - V21, V22, V23
Narrow picture - V21, V22, V23, V24, V25
Vert. off freq. - V17, V18
Horiz. off freq. - V17, V20, V21

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage shock hazard may be eliminated by removing V21 during alignment.

VIDEO IF ALIGNMENT

Connect the negative lead of a bias supply, capable of at least 6 volts supply, to the ungrounded side of C2. Positive lead to chassis.
If making a complete IF alignment start by turning slugs A1 thru A11 all the way counter clockwise. Then turn A8 and A10 three turns clockwise, A9 and A11 five turns clockwise and A2 four turns clockwise.
Use only enough sweep and marker output to provide usable indication on scope.
Connect a 470MMF capacitor from pin 1 (grid) of V4 to chassis.
Short tuner and IF AGC together with a jumper lead.
If a separate marker generator is used, connect to point (B) and chassis.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	Direct	Across antenna terminals.	43.25MC (10MC Swp)	41.25MC	12	Vert. amp. thru detector probe (Fig. 1) to primary of L14. Low side to chassis.	A1	Remove 2nd IF tube (V4) from its socket. Set bias at -2.5 volts. Adjust A1 for minimum amplitude at 41.25MC on response curve as in Fig. 2.
2.	"	"	"	45.75MC	"	"	A2, A3	Leave bias at -2.5 volts with V4 tube removed. Adjust for response curve similar to Fig. 2. Adjust A2 for flatness of response curve and A3 for position of 45.75MC marker. Replace V4 in its socket.
3.	"	High side to point B. Low side to chassis.	Not used.	39.75MC (400∿ Mod)	"	Vert. amp. to pin 5 (plate) of 6AU6 (V7). Low side to chassis.	A4, A5	With bias set a -4 volts, adjust A4 and A5 for MINIMUM 400∿ indication on scope.
4.	"	"	"	41.25MC (400∿ Mod)	"	"	A6, A1	With bias set at -4 volts, adjust for MINIMUM 400∿ indication on scope.
5.	"	"	"	47.25MC (400∿ Mod)	"	"	A7	"
6.	"	"	"	45.25MC (400∿ Mod)	"	"	A8	With bias set at -4 volts, adjust for maximum 400∿ indication on scope.
7.	"	"	"	42.8MC (400∿ Mod)	"	"	A9	"
8.	"	"	"	45.75MC (400∿ Mod)	"	"	A10	"
9.	"	"	"	41.8MC (400∿ Mod)	"	"	A11	"

OVERALL VIDEO IF RESPONSE CHECK

Connect the negative lead of a 4 volt bias supply to the ungrounded side of C2. Positive lead to chassis. Short tuner and AGC together with a jumper lead.
Use only enough sweep to produce usable pattern on scope.
Remove converter tube (V2) from its socket and replace with a 6J6 which has pin 1 removed.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
10.	Direct	High side to an ungrounded tube shield floating over dummy converter tube. Low side to chassis.	43.5MC (10MC Swp)	39.75MC 41.25MC 42.2MC 43.1MC 45.0MC 45.75MC 47.25MC	Any	Vert. amp. to point (A). Low side to chassis.		Check for response similar to Fig. 3. If necessary, retouch A1 thru A11. SLIGHTLY readjust A10 for placement of 45.75MC marker, A9 for placement of 43.1MC marker and A8 which places the 45.0MC marker on the slope portion of the response curve. Replace V2 in its socket.

SOUND IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Connect the negative lead of a 6 volt bias supply to the ungrounded side of C2. Positive lead to chassis. This will eliminate any strong signals interfering with alignment. Use only enough signal generator output to provide accurate reading on VTVM.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
11.	.01MFD	High side to pin 1 (grid) of 6CB6 (V3). Low side to chassis.	4.5MC (unmod)	Any non-interfering channel.	DC probe to point (C). Common to chassis.	A12, A13, A14	Adjust for maximum deflection.
12.	"	"	"	"	DC probe to point (D). Common to point (C).	A15	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.

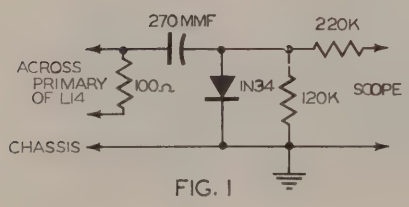

FIG. 1

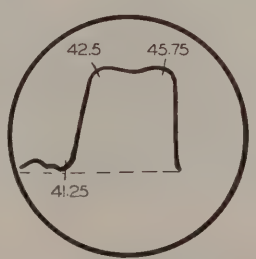

FIG. 2

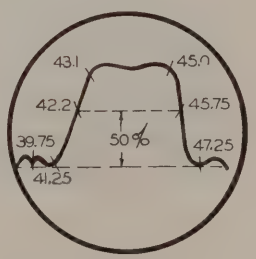

FIG. 3

ALIGNMENT INSTRUCTIONS (cont)

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60∿ modulation and 450KC sweep. Use 120∿ sawtooth voltage in scope for horizontal deflection.
Remove V2 from its socket.
Use only enough generator output to produce usable pattern on scope.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
11.	.01MFD	High side to pin 1 (grid) of 6CB6 (V3). Low side to chassis.	4.5MC (450KC Swp)	4.5MC	Any	Vert. amp. thru 10KΩ to point Ⓒ. Low side to chassis.	A12, A13, A14	Disconnect stabilizing capacitor (C4). Adjust for curve of maximum amplitude and symmetry similar to Fig. 4.
12.	"	"	"	"	"	Vert. amp. thru 10KΩ to point Ⓓ. Low side to chassis.	A15	Reconnect stabilizing capacitor (C4). Adjust so that 4.5MC occurs at center of crossover lines as in Fig. 5. SLIGHTLY adjust A14 for maximum amplitude and straightness of crossover lines. Replace V2 in its socket.

4.5MC TRAP ALIGNMENT

Tune in a TV station and note if 4.5MC beat pattern appears in picture. Adjust A16 for minimum 4.5MC beat in picture.

OSCILLATOR ALIGNMENT

Remove the dummy converter tube and replace the original 6J6 in its socket. The channel oscillator screws are reached through a hole just to the right of the channel switch shaft. The correct adjustment screw is accessible through this hole as the channel switch is turned to each channel.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.
Connect AGC as in "Overall Video IF Response Check".

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
13.	Two 120Ω carbon resistors	Across antenna terminals with 120Ω in each lead.	207MC (10MC Swp)	205.25MC 209.75MC	12	Vert. amp. to point Ⓐ. Low side to chassis.	A17	Advance scope gain so that sound trap notch is visible on response curve. Adjust to place sound marker in trap notch. Video marker should fall at 50% response on opposite slope of response curve as in Fig. 6.
			213MC (10MC Swp)	211.25MC 215.75MC	13		A18	
			201MC (10MC Swp)	199.25MC 203.75MC	11		A19	
			195MC (10MC Swp)	193.25MC 197.75MC	10		A20	
			189MC (10MC Swp)	187.25MC 191.75MC	9		A21	
			183MC (10MC Swp)	181.25MC 185.75MC	8		A22	
			177MC (10MC Swp)	175.25MC 179.75MC	7		A23	
			85MC (10MC Swp)	83.25MC 87.75MC	6		A24	
			79MC (10MC Swp)	77.25MC 81.75MC	5		A25	
			69MC (10MC Swp)	67.25MC 71.75MC	4		A26	
			63MC (10MC Swp)	61.25MC 65.75MC	3		A27	
			57MC (10MC Swp)	55.25MC 59.75MC	2		A28	

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RF AND MIXER ALIGNMENT

Connect AGC as in "Overall Video IF Response Check".
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
14.	Two 120Ω carbon resistors	Across antenna terminals with 120Ω in each lead.	207MC (10MC Swp)	205.25MC 209.75MC	12	Vert. amp. to point Ⓑ. Low side to chassis.	A29, A30, A31	Adjust for maximum response similar to Fig. 7.
15.	"	"	213MC (10MC Swp)	211.25MC 215.75MC	13	"		Check for response similar to Fig. 7. If markers fall below 70% on any channel, make compromise adjustments of A29, A30 and A31 with channel switch set to that channel. Then recheck all other channels to see that they have not been seriously affected
			201MC (10MC Swp)	199.25MC 203.75MC	11			
			195MC (10MC Swp)	193.25MC 197.75MC	10			
			189MC (10MC Swp)	187.25MC 191.75MC	9			
			183MC (10MC Swp)	181.25MC 185.75MC	8			
			177MC (10MC Swp)	175.25MC 179.75MC	7			
			85MC (10MC Swp)	83.25MC 87.75MC	6			
			79MC (10MC Swp)	77.25MC 81.75MC	5			
			69MC (10MC Swp)	67.25MC 71.75MC	4			
			63MC (10MC Swp)	61.25MC 65.75MC	3			
			57MC (10MC Swp)	55.25MC 59.75MC	2			

IF TRAP ALIGNMENT

A trap is provided in the input section of the tuner for the purpose of reducing interference on channel 2 from transmitters operating in the 40MC band. If such interference is noted, adjust A32 to minimize it.

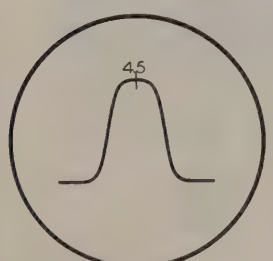


FIG. 4

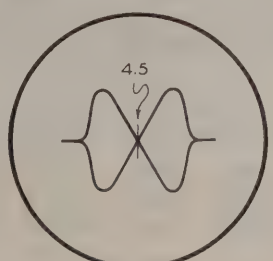


FIG. 5

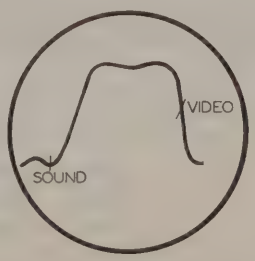


FIG. 6

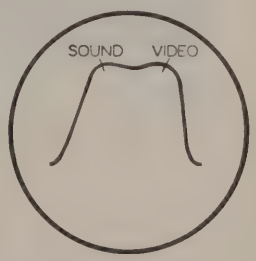
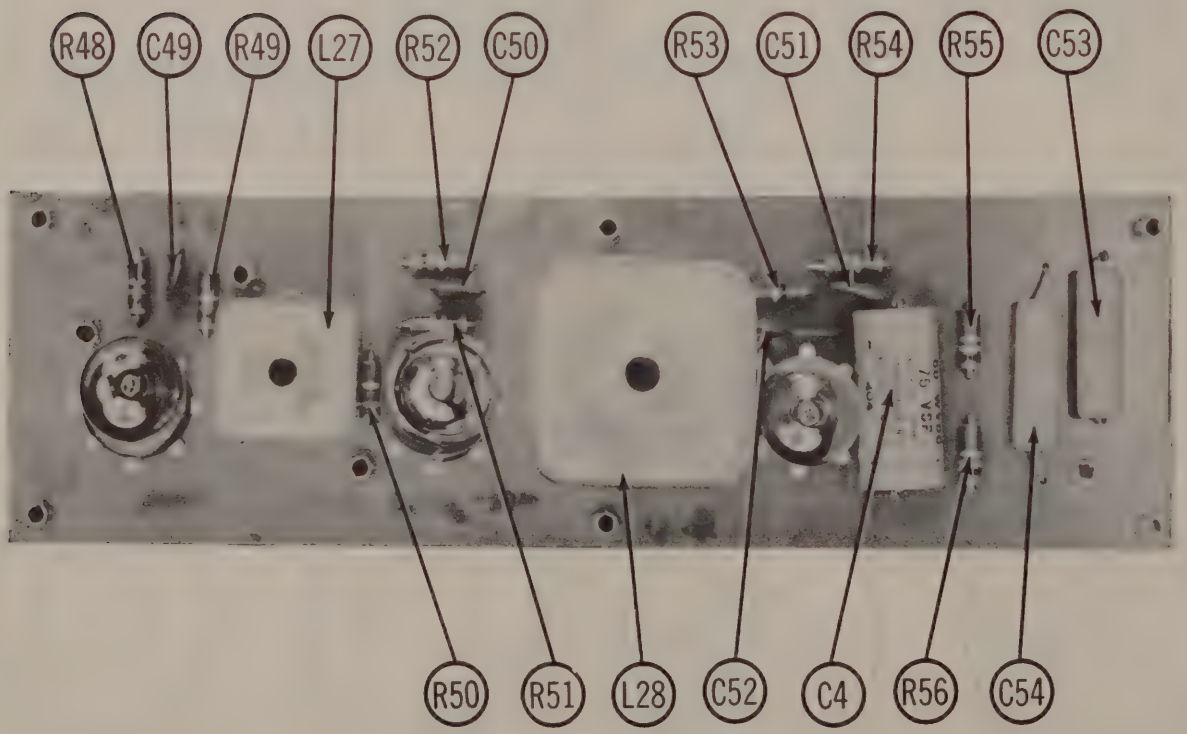


FIG. 7

RESISTANCE MEASUREMENTS

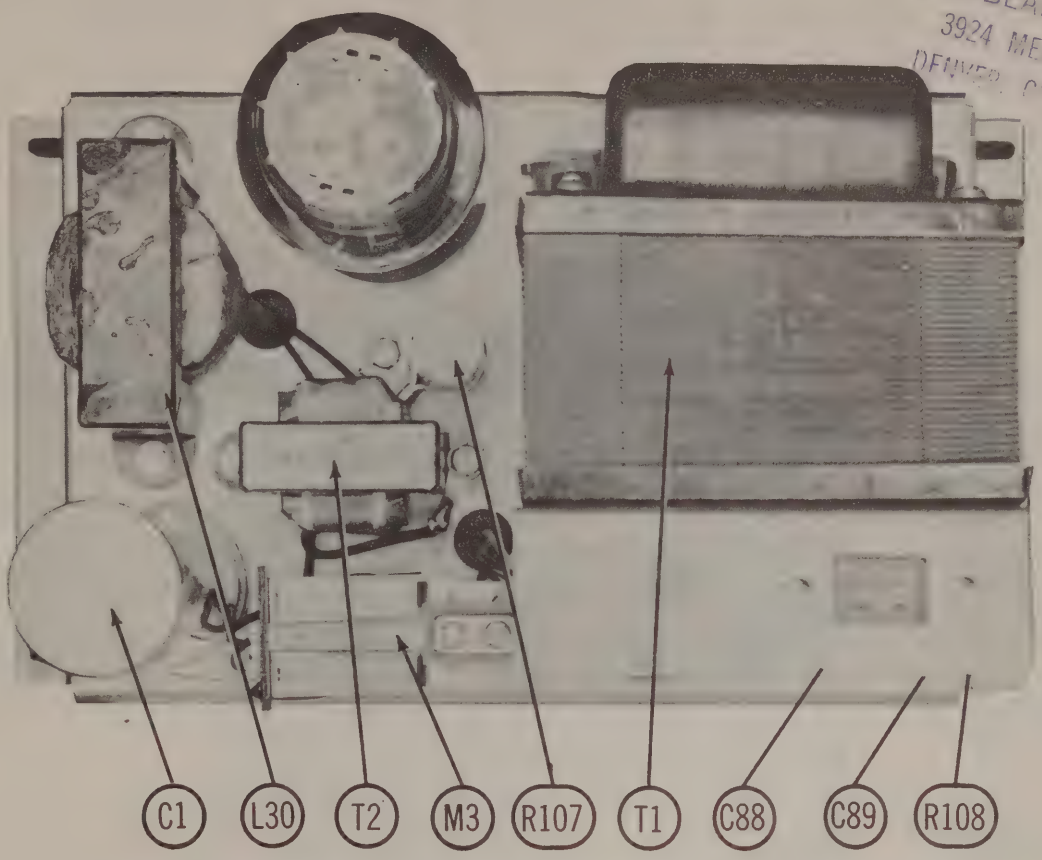
Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6BQ7A	INF	500KΩ	0Ω	.1Ω	0Ω	†5KΩ	220KΩ	INF	0Ω
V 2	6J6	†7KΩ	†18KΩ	.1Ω	0Ω	235KΩ	10KΩ	0Ω		
V 3	6CB6	40KΩ	47Ω	.1Ω	0Ω	†4.4KΩ	†4.4KΩ	0Ω		
V 4	6CB6	40KΩ	47Ω	.1Ω	0Ω	†4.4KΩ	†4.4KΩ	0Ω		
V 5	6CB6	.1Ω	180Ω	.1Ω	0Ω	†3.5KΩ	†3.5KΩ	0Ω		
V 6	6CB6	.1Ω	820Ω	.1Ω	0Ω	†3.5KΩ	†3.5KΩ	0Ω		
V 7	6AU6	3.9KΩ	0Ω	0Ω	.1Ω	†5.8KΩ	†2.5KΩ	.1Ω		
V 8	6AR5	470KΩ	2KΩ	.1Ω	0Ω	†5KΩ	†2.5KΩ	NC		
V 9	6AL5	1.5Meg	370KΩ	.1Ω	0Ω	0Ω	0Ω	0Ω		
V 10	6AU6	†50KΩ	†2.5KΩ	0Ω	.1Ω	150KΩ	†38Ω	†2.5KΩ		
V 11	6AU6	.1Ω	0Ω	0Ω	.1Ω	†3.5KΩ	†3.5KΩ	100Ω		
V 12	6AU6	2.9Ω	0Ω	0Ω	.1Ω	†3.5KΩ	†3.5KΩ	100Ω		
V 13	6AL5	INF	INF	.1Ω	0Ω	0Ω	0Ω	20KΩ		
V 14	6AU6	1Meg	0Ω	0Ω	.1Ω	†500KΩ	†1Meg	1.8KΩ		
V 15	6AQ5	500KΩ	1KΩ	.1Ω	0Ω	†1.4KΩ	†1KΩ	500KΩ		
V 16	6AU6	5Meg	0Ω	0Ω	.1Ω	†118KΩ	†35KΩ	0Ω		
V 17	6C4	†5.8KΩ	NC	.1Ω	0Ω	†5.8KΩ	470KΩ	3.4KΩ		
V 18	12AU7	▲440KΩ	560KΩ	1KΩ	0Ω	0Ω	▲1Meg	3Meg	1KΩ	.1Ω
V 19	6W6GT	TP	0Ω	†3KΩ	†3.1KΩ	1.5Meg	NC	.1Ω	1.4KΩ	
V 20	6AL5	27Ω	27Ω	0Ω	.1Ω	5Meg	0Ω	5Meg		
V 21	6SN7GT	120KΩ	†150KΩ	1.5KΩ	5Meg	†6.8KΩ	1.5KΩ	0Ω	.1Ω	
V 22	6AU5GT	470KΩ	.1Ω	180Ω	NC	▲28Ω	NC	0Ω	†8.2KΩ	
V 23	6W4GT	NC	NC	700KΩ	NC	†38Ω	NC	700KΩ	700KΩ	
V 24	1B3GT		PINS	1 - 8	HAVE	INFINITE	RESISTANCE			Top Cap ▲442Ω
V 25	5U4G	NC	40KΩ	NC	22Ω	NC	21Ω	NC	40KΩ	
V 26	24CP4A	0Ω	1.6Meg	Pin 10 †38Ω	Pin 11 †300KΩ	Pin 12 .1Ω				

† MEASURED FROM PIN 2 OF V25.
▲ MEASURED FROM PIN 3 OF V23.
NC - NO CONNECTION

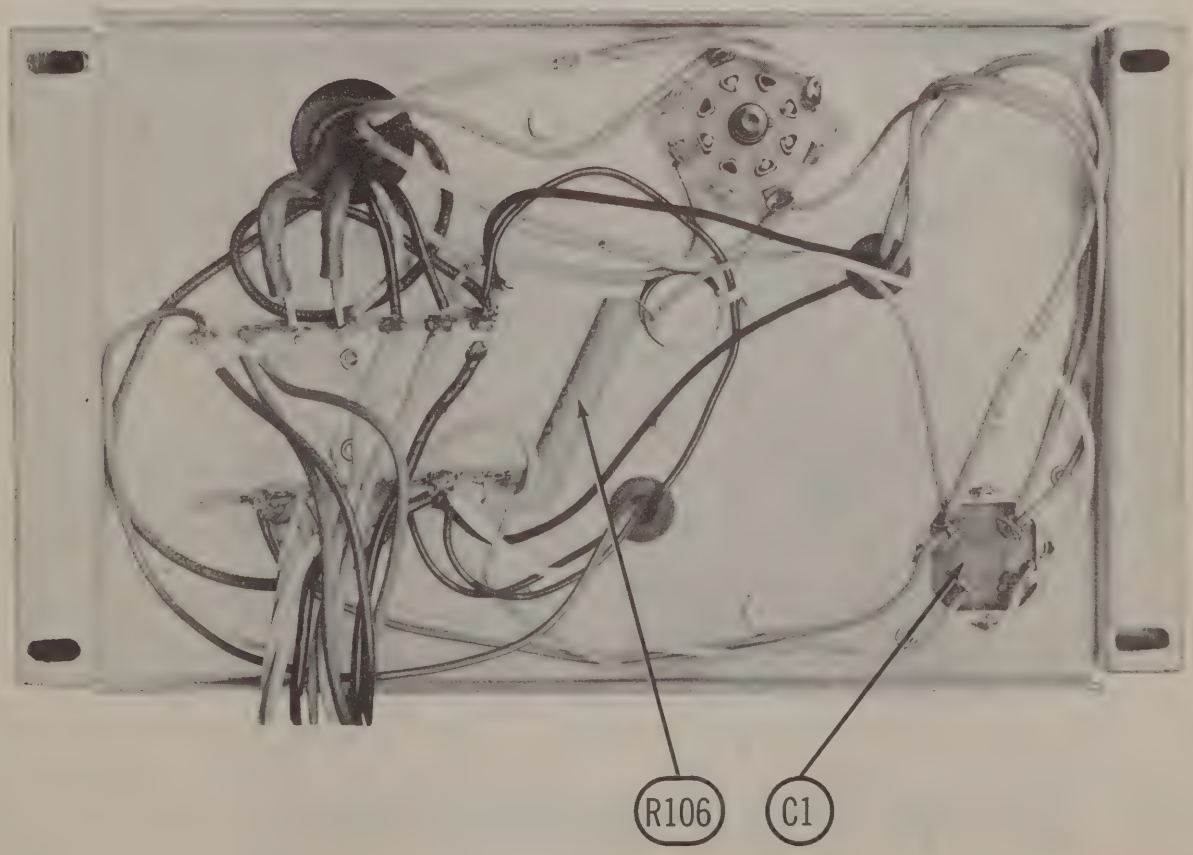


SUB-CHASSIS #3 SOUND IF UNIT

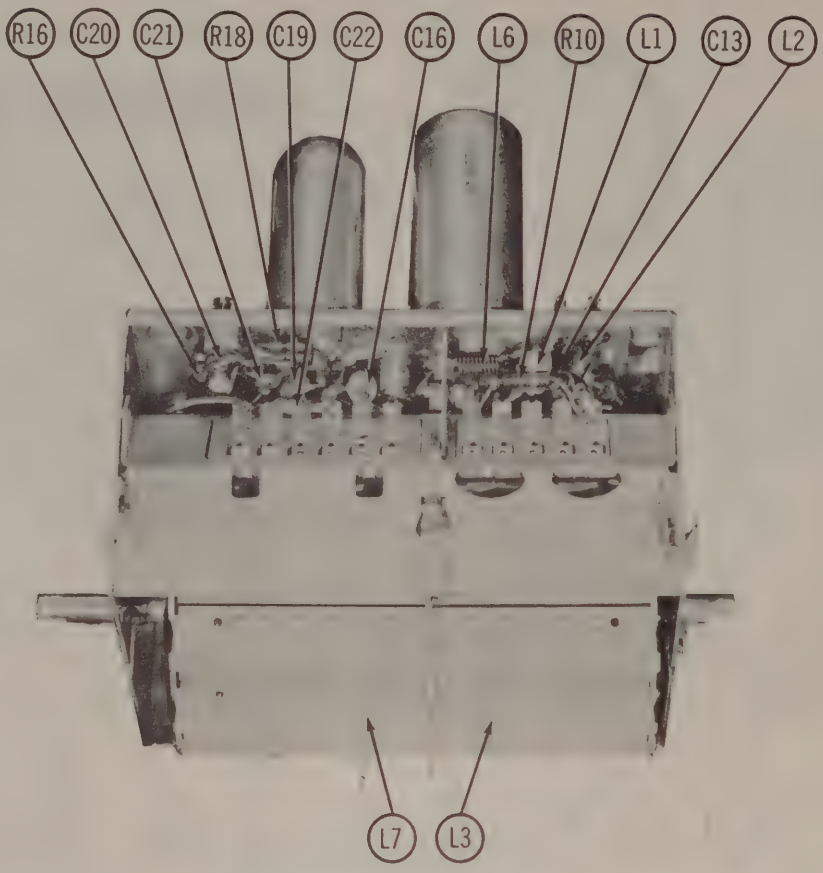
PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLO.



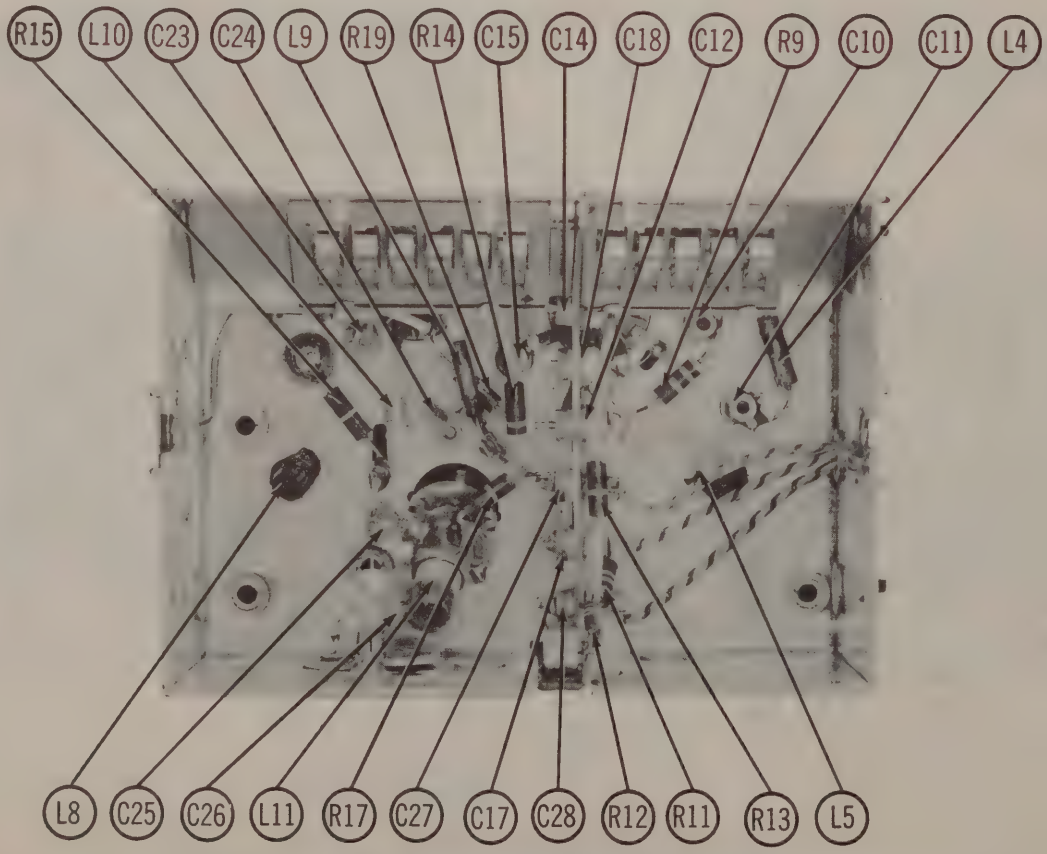
SUB-CHASSIS #4 LV POWER SUPPLY (TOP VIEW)



SUB-CHASSIS #4 LV POWER SUPPLY (BOTTOM VIEW)

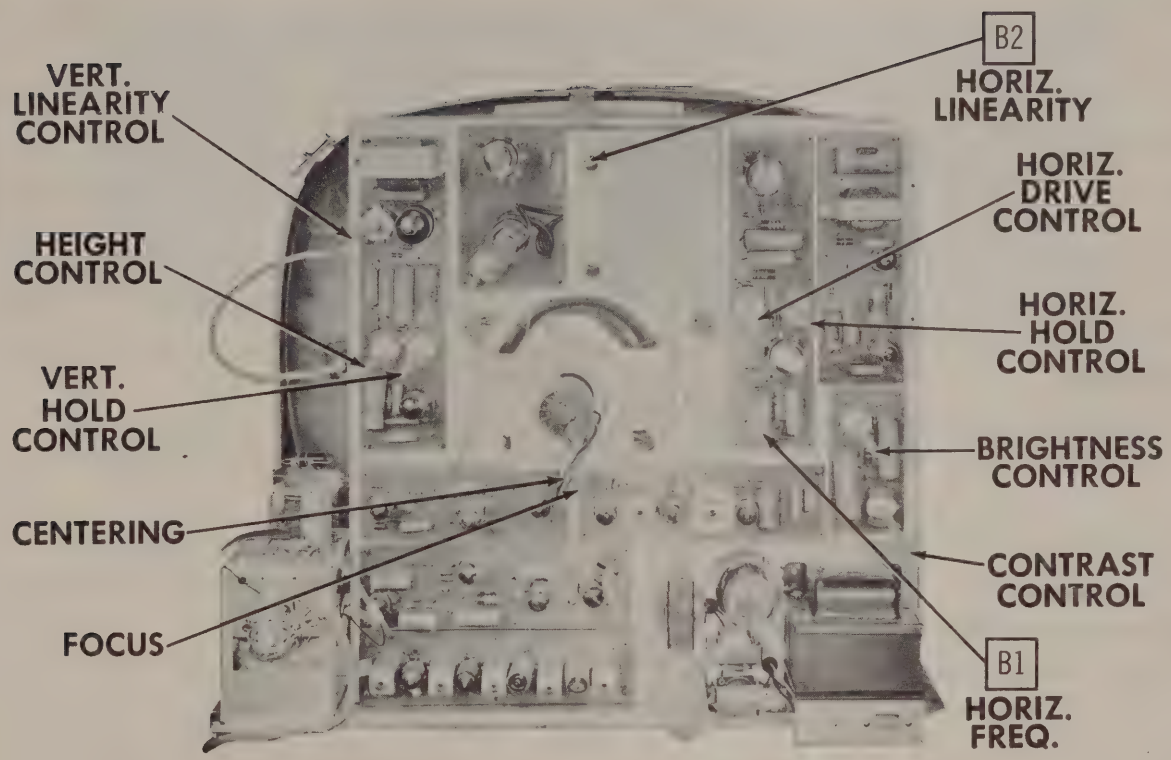


RF TUNER-RIGHT SIDE



RF TUNER-BOTTOM VIEW

PROPERTY OF
L. F. BLANKENSHIP



CHASSIS—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern.

1. Set the horizontal hold control (R4) to its mid-range position.
2. Adjust the horizontal oscillator coil (B1) until picture locks in horizontally.
3. Switch off channel and back again; picture should pull into sync.

Adjust the horizontal drive control (R5) clockwise until a white vertical line appears, then turn counter clockwise until white line disappears.

Adjust the horizontal linearity slug (B2) for a picture that is symmetrical from left to right.

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage".

INSUFFICIENT SWEEP

Check by substitution V22, V23 and V25. Check T3, T5A, C78, C77, C81, R102, R103, R5 and other associated components.

DRIVE LINES

Check by substitution V22 and V23. Check T3, T5A, R5, R102, C78 and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V22 and V23. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines".

PIE CRUST EFFECT

Check by substitution V21, V22 and V23. Check C75 for open. Check L29, C76, C74, R95 and other associated components.

XMAS TREE EFFECT

Check by substitution V21, V22 and V23. Check T3 and T5 for internal arcing. Check L29, C76, C71, C72, C73, C78 and other associated components.

VERTICAL

LOSS OF SWEEP

Check by substitution V18 and V19. Check waveform W10.

If Satisfactory	If Unsatisfactory
Check T4, T5B, R88, R84, C9 and other associated components.	Check R78, R80, R81, R77, C66, C65, C68 and other associated components.

INSUFFICIENT SWEEP

Check by substitution V18 and V19. Check height and vertical linearity for proper operation.

COMPRESSED AT BOTTOM

Check by substitution V18 and V19. Check R81, R7, R80, C8, C65, C68 and other associated components.

COMPRESSED AT TOP

Check by substitution V18 and V19. Check R8, R84, C9, T4 and other associated components.

FOLDS

Check by substitution V18 and V19. Check R82, C67, C68 and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Check by substitution V16 and V17. Check C60, C61, C62, R68, R69, R67, R74 and other associated components.

LOSS OF VERTICAL SYNC-HORIZONTAL SYNC SATISFACTORY

Substitute V18. Check vertical integrator network. Check R6, R79, R77, R76, C66, C65 and other associated components.

LOSS OF HORIZONTAL SYNC-VERTICAL SYNC SATISFACTORY

Check by substitution V20 and V21. Check C72, C73, C74, C76, L29, R95, R96, R4 and other associated components.

HORIZONTAL BENDING

Check by substitution V16, V17, V20 and V21. Check horizontal AFC network.

VIDEO

LOSS OF VIDEO

Check by substitution V7 and V8. Check C44, C46, R32, R37, R38, L26 and other associated components.

SOUND BARS(4.5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check adjustment A16. Check video IF Alignment.

POOR CONTRAST

Check by substitution V7 and V8. Check C43, C44, C45, C46, L24, L25, R37, R38 and other associated components.

NEGATIVE PICTURE

Check by substitution V7 and V8. Check picture tube. Check C44, C46, R36, L22 and other associated components.

SMEAR

Check by substitution V7 and V8. Check crystal detector network. Check L21, L22, L24, L25, C44, C46 and other associated components.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V1, V3, V4, V5, V6, V7 and V8 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V11, V12, V13, V14 and V15, Check stages V14 and V15 using audio signal generator. Apply audio signal at point ⊕.

If Satisfactory	If Unsatisfactory
Check ratio detector and audio IF stages for component failure or changes of value.	Check C54, C56, C57, C58, C59, R60, R62, R63, T8, speaker and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustment A15 for minimum buzz. If still unsatisfactory, check audio IF alignment.

DISTORTED

Follow procedure outlined under "Weak or no Sound".

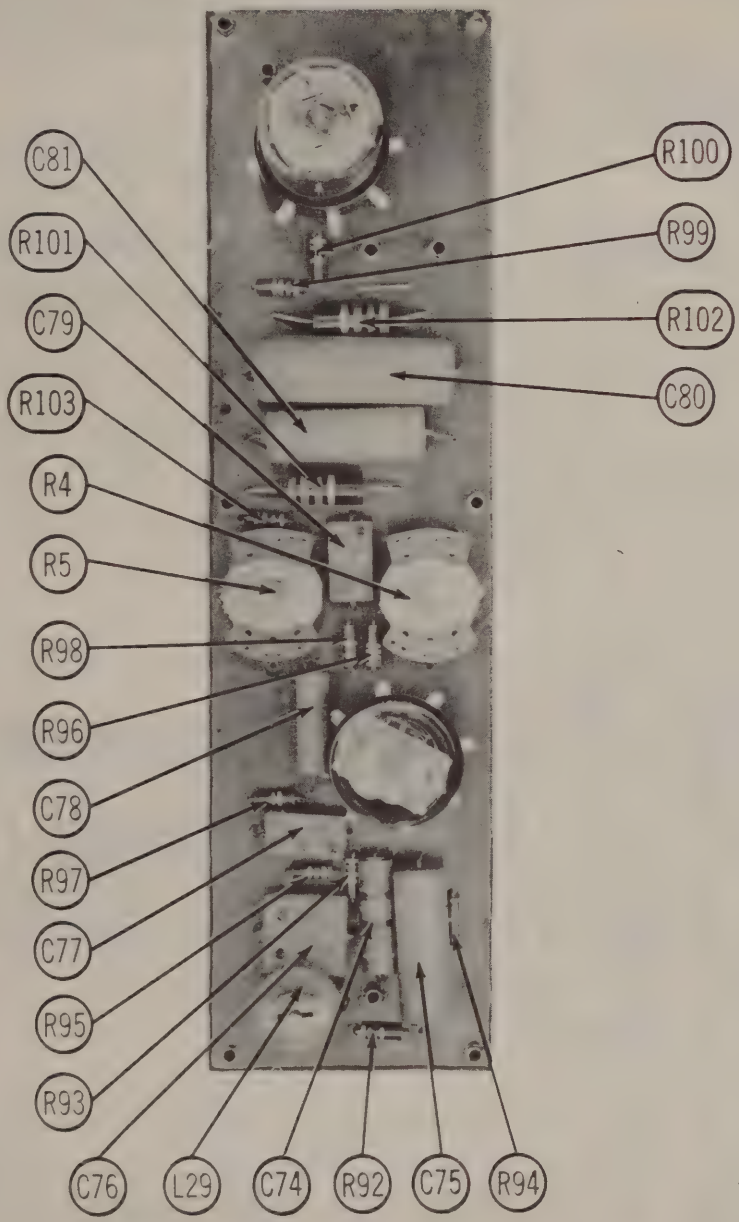
POWER

DEAD SET

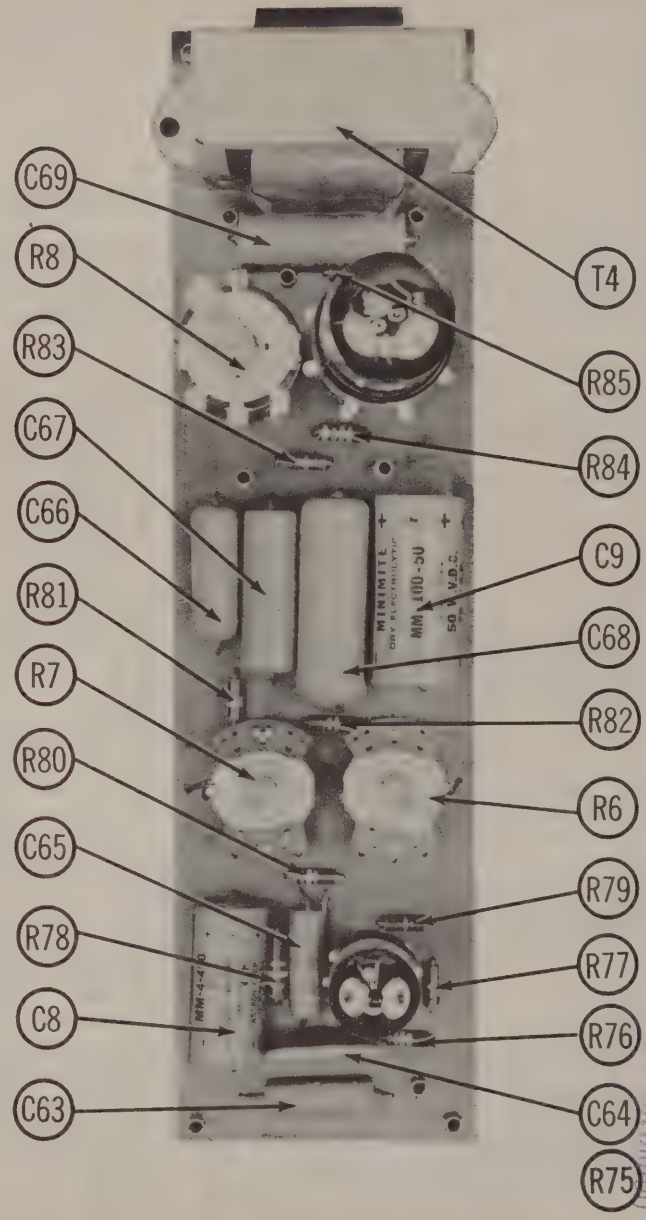
If filaments fail to light, check AC interlock assembly. Check switch on volume control and T1. If filaments light, substitute V25. Check B+ filter and decoupling network.

SMALL AND/OR DIM PICTURE

Substitute V25. Check B+ filter and decoupling network.



SUB-CHASSIS #5 HORIZ. OSC. UNIT



SUB-CHASSIS #6B VERTICAL UNIT

PROPERTY OF
L. F. BLANKENSHIP
3091 MEADE ST.
DENVER, COLORADO

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: WALSCO PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amplifier	6BQ7A	6BQ7A	9AJ	
V2	Osc.-Mixer	576	6J6	7BF	
V3	1st. Video IF Amp.	6CB6	6CB6	7CM	
V4	2nd. Video IF Amp.	6CB6	6CB6	7CM	
V5	3rd. Video IF Amp.	6CB6	6CB6	7CM	
V6	4th. Video IF Amp.	6CB6	6CB6	7CM	
V7	Video Amplifier	6AU6	6AU6	7BK	
V8	Video Output	6AR5	6AR5	6CC	6AQ5 used as alternate
V9	DC Restorer-- AGC Clamper	6AL5	6AL5	6BT	
V10	AGC Keying	6AU6	6AU6	7BK	
V11	1st. Sound IF Amp.	6AU6	6AU6	7BK	
V12	2nd. Sound IF Amp.	6AU6	6AU6	7BK	
V13	Ratio Detector	6AL5	6AL5	6BT	
V14	AF Amplifier	6AU6	6AU6	7BK	
V15	Audio OutPut	6AQ5	6AQ5	7BX	
V16	Sync Separator	6AU6	6AU6	7BK	
V17	Sync Phase Inv.	6C4	6C4	6BG	
V18	Vert. Mult.	12AU7	12AU7	9A	
V19	Vert. Output	6W6GT	6W6GT	7S	
V20	Horiz. AFC	6AL5	6AL5	6BT	
V21	Horiz. Mult.	6BW7GT	6BW7GT	9BD	
V22	Horiz. Output	6AU5GT	6AU5GT	6CK	
V23	Damper	6W4GT	6W4GT	4CG	
V24	HV Rectifier	1B3GT	1B3GT	5C	
V25	LV Rectifier	5U4G	5U4G	5T	

CATHODE-RAY TUBE

ITEM No	REPLACEMENT DATA: WALSCO PART No	CBS PART No	GENERAL ELECTRIC PART No	SYLVANIA PART No	WESTINGHOUSE PART No	RETMA BASE TYPE	NOTES
V26	24CP4A① ② 27RP4 ④	24CP4A ① 27RP4	24CP4A ① 27RP4	24CP4A ④ 27EP4/ 27RP4 ③	24CP4A①	12N 12N	① Aluminized ④ These tubes are recommended by Mfgr. ③ Silver screen
	21RP4 ④ 21KP4 ④						
		21ZP4A 21ZP4B ②	21ZP4A 21ZP4B ①	21ZP4A 21ZP4B ③	21ZP4A 21ZP4B ①	12N 12N	

ELECTROLYTIC CAPACITORS

ITEM No	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: WALSCO PART No	REPLACEMENT DATA: MALLORY PART No	REPLACEMENT DATA: PYRAMID PART No	REPLACEMENT DATA: SANGAMO PART No	NOTES
C1A	±40	400		FP378	TM-804020-	C-25	
B	±80	400		TC78	-450	MT-4520	
C	±40	350			TD-40-350		
D	30	350					
C2	5	50		TC30	TD-5-50	MMT-0505	
C3	5	50		TC30	TD-5-50	MMT-0505	
C4	5	50		TC30	TD-5-50	MMT-0505	
C5	5	50		TC30	TD-5-50	MMT-0505	
C6	20	350		TC25	TD-20-350	FM-4520	
C7	25	50		TC36	TD-25-50	FM-0525	
C8	4	450		TC70	TD-4-450	FM-4504	
C9	100	50		TC150	TD-100-50	MT8-5010	

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: WALSCO PART No.	REPLACEMENT DATA: CENTRALAB PART No.	REPLACEMENT DATA: ERIE PART No.	REPLACEMENT DATA: MALLORY PART No.	NOTES
C10	3-9			829-10			
C11	3-9			829-10			
C12	1000			TCZ-3	MPGA-050	Z7-5333	
C13	3						
C14	1000			829-3	3115-01-GR5	CT565A	
C15	.5-3			DH-131	811-131	UC-5313	
C16	130						
C17	1000						
C18	1000			DS-510	831-510	UC-545	
C19	51			829-3	3115-01-GR5	CT565A	
C20	.5-3			TCZ-10	MPGK-100	Z7-541	
C21	10						
C22	5			DD-152	801-0015	DC-5315	
C23	1500			DD-152	801-0015	DC-5315	
C24	1500			TCZ-6.8	MPGK-6R8	Z7-5868	
C25	6.8			DS-560	831-560	UC-5456	
C26	56						
C27	1000						
C28	1000			DD-152	801-0015	DC-5315	
C29	1500			DD-102	801-001	DC-521	
C30	1000			DD-471	831-471	UC-5347	
C31	470			DD-102	801-001	DC-521	
C32	1000			DD-102	801-001	DC-531	
C33	1000			DD-102	801-001	DC-531	
C34	470			DD-471	831-471	UC-5347	
C35	1000			DD-102	801-001	DC-531	
C36	470			DD-471	831-471	UC-5347	
C37	1000			DD-102	801-001	DC-531	
C38	1000			DD-102	801-001	DC-531	
C39	1000			DD-102	801-001	DC-531	
C40	1000			DD-102	801-001	DC-531	
C41	1000			DD-102	801-001	DC-531	
C42	5			TCZ-5	MPGA-050	Z7-555	
C43	1000	500				MCE255	
C44	.047	600		DF-503		PT6147	
C45	1000			DD-102	801-001	DC-531	
C46	.047	600		DF-503		PT6147	
C47	5000			DD-502	811-005	DC-525	
C48	5000			DD-502	811-005	DC-525	
C49	5000			DD-502	811-005	DC-525	

CAPACITORS (cont)

ITEM No.	RATING: CAP.	RATING: VOLT.	REPLACEMENT DATA: WALSCO PART No.	REPLACEMENT DATA: CENTRALAB PART No.	REPLACEMENT DATA: ERIE PART No.	REPLACEMENT DATA: MALLORY PART No.	NOTES
C50	5000			DD-502	811-005	DC-525	
C51	5000			DD-502	811-005	DC-525	
C52	1000			DD-102	801-001	DC-531	
C53	.003	600		DS-303	GP2-333-302	PT6233	
C54	.022	300		DF-303	817-02	PT6133	
C55	5000			DD-502	811-005	DC-535	Note 1
C56	.022	300		DF-303	817-02	PT6133	
C57	.1	400		DF-104		PT6401	
C58A	5000			TPC-70	†1406-01		
B	250						
C							
C59	.005	400		DS-502	GP2-333-502	PT6235	
C60	.0047	600		DS-472	GP2-333-472	PT6247	
C61	270			DS-271	GP2K-271	DC-5327	
C62	.047	400		DF-503		PT6147	
C63	.0047	600		DS-472	GP2-333-472	PT6247	
C64A	2000					DC-523	
B	1500				◆1405-01	DC-525	
C	5000					DC-525	
C65	.004	600		DS-402	GP2-333-402	PT6234	
C66	.047	400		DF-503		PT6147	
C67	.047	600		DF-503		PT6147	
C68	.1	600		DF-104		PT6401	
C69	.047	600		DF-503		PT6147	
C70	.22	400				PT6023	
C71	.22	600				PT6023	
C72	1000			DS-102	GP2L-102	UC-521	
C73	1000			DS-102	GP2L-102	UC-521	
C74	.01	400		DS-103	GP2-333-103	PT4U	
C75	.047	600		DF-503		PT6147	
C76	4000	500				MCB463	
C77	500	500				MCB545	
C78	.002	600		DS-202	GP2-333-202	PT6232	
C79	330	500					
C80	.22	400				PT6023	
C81	.22	400				PT6023	
C82	.03	600				PT613	
C83	56	2000		DD-30-560	3KV-560	MC1456	
C84	.039	400					Note 1
C85	500	20000		TY5-502	415	HV20038A	
C86	56	3000		DD-30-560	3KV-560	MC1456	
C87	82	2000		DD-30-820		MC1482	
C88	.0047	400		DS-472	GP2-333-472	PT6247	
C89	.0047	400		DS-472	GP2-333-472	PT6247	
C90	.1	400		DF-104		PT401	

Note 1. Not used in some versions.
† Items C58A, C58B, C58C, R61A, and R61B are combined in one unit. When replacing items separately C58B and C58C should total 250MMF.
◆ Items C64A, C64B, C64C, R75A, R75B and R75C are combined in one unit.

CONTROLS

ITEM No	RATING: RESIST ANCE	RATING: WATTS	REPLACEMENT DATA: WALSCO PART No	REPLACEMENT DATA: IRC PART No	REPLACEMENT DATA: CLAROSTAT PART No	REPLACEMENT DATA: CENTRALAB PART No	REPLACEMENT DATA: MALLORY PART No	INSTALLATION NOTES
R1A	500KΩ	‡	CM15P4			ASF-54		Volume tapped at 50KΩ
B	Shaft		Not Req.			AK-3		Attach to R1A
C	Switch		Not Req.			KB-1		Attach to R1A
R2	5000Ω	‡	BA01-1388					Contrast
R3	500KΩ	‡	BA01-1387					Brightness
R4	100KΩ	‡	BA01-1390					Horiz. Hold - Note
R5	1000Ω	‡	BA01-1389					Horiz. Drive
R6	2Meg	‡	BA01-1386					Vert. Hold
R7	500KΩ	‡	BA01-1387					Height
R8	1000Ω	‡						Vert. Linearity (Wire wound)

Note: Not used in some versions.

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: WALSCO PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R9	47KΩ	‡	BT8-47K		
R10	15KΩ	‡	BT8-15K		
R11	180KΩ	‡	BT8-180K		
R12	270KΩ	‡	BT8-270K		
R13	100KΩ	‡	BT8-100K		
R14	470Ω	‡	BT8-470		
R15	220KΩ	‡	BT8-220K		
R16	15KΩ	‡	BT8-15K		
R17	15KΩ	‡	BT8-15K		
R18	10KΩ	‡	BT8-10K		
R19	4700Ω	‡	BT8-4700		
R20	4700Ω	2	BTB-4700		
R21	470Ω	‡	BT8-470		
R22	47Ω	‡	BT8-47		
R23	1800Ω	‡	BT8-1800		
R24	470Ω	‡	BT8-470		
R25	47Ω	‡	BT8-47		
R26	1800Ω	‡	BT8-1800		
R27	180Ω	‡	BT8-180		
R28	1000Ω	‡	BT8-1000		
R29	820Ω	‡	BT8-820		
R30	1000Ω	‡	BT8-1000		
R31	3900Ω	‡	BT8-3900		
R32	3300Ω	‡	BT8-3300		
R33	39KΩ	‡	BT8-39K		
R34	47KΩ	‡	BT8-47K		
R35	470KΩ	‡	BT8-470K		
R36	470Ω	2	BTB-470		
R37	12KΩ	1	BTA-12K		
R38	8200Ω	2	BTB-8200		
R39	68KΩ	‡	BT8-68K		

RESISTORS (cont)

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: WALSCO PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R40	1.5Meg	‡		BT8-1.5Meg	
R41	180KΩ	‡		BT8-180K	
R42	270KΩ 5%	‡		BTS-470K 5%	
R43	5.6Meg 5%	‡		BTS-5.6Meg 5%	
R44	330KΩ	‡		BT8-330K	
R45	22KΩ	‡		BT8-22K	
R46	1Meg	‡		BTS-1Meg	
R47	100KΩ	‡		BTS-100K	
R48	100Ω	‡		BTS-100	
R49	1000Ω	‡		BTS-1000	
R50	5600Ω	‡		BTS-5600	
R51	100Ω	‡		BTS-100	
R52	1000Ω	‡		BTS-1000	
R53	82Ω	‡		BTS-82	
R54	22KΩ	‡		BT8-22K	
R55	10KΩ	‡		BT8-10K	
R56	10KΩ	‡		BT8-10K	
R57	1Meg	‡		BT8-1Meg	
R58	1800Ω	‡		BT8-1800	
R59	39Ω	‡		BTS-39	
R60	1Meg	‡		BT8-1Meg	
R61A	500KΩ	‡		BTS-470K	†
B	500KΩ	‡		BTS-470K	
R62	1000Ω	1		BTA-1000	
R63	1000Ω	1		BTA-1000	
R64	1000Ω	‡		BTS-1000	
R65	4.7Meg	‡		BT8-4.7Meg	
R66	470KΩ	‡		BT8-470K	
R67	37KΩ	‡		BT8-37K	
R68	100KΩ	‡		BT8-100K	

RESISTORS (cont)

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: WALSCO PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R89	220KΩ	‡		BT8-220K	
R90	100KΩ 5%	‡		BTS-100K 5%	
R91	100KΩ 5%	‡		BTS-100K 5%	
R92	4.7Meg	‡		BTS-4.7Meg	
R93	470KΩ	‡		BT8-470K	
R94	1500Ω	‡		BT8-1500	
R95	6800Ω	‡		BT8-6800	
R96	68KΩ	‡		BT8-68K	Note 1
R97	150KΩ	‡		BT8-150K	
R98	5600Ω	‡		BT8-5600	
R99	470KΩ	‡		BT8-470K	
R100	47Ω	‡		BT8-47	
R101	18Ω	2			Note 2
R102	9300Ω	2		BTB-9300	
R103	680Ω	2		BTB-680	Note 3
R104	3.3Ω	1			
R105	1000Ω	‡		BT8-1000	
R106	2700Ω	5			
R107	2500Ω	20			
R108	220KΩ	‡		BTS-220K	
R109	47KΩ	‡		BTS-47K	Note 3

† Items R61A, R61B, C58A, C58B and C58C are combined in one unit.
◆ Items R75A, R75B, R75C, C64A, C64B and C64C are combined in one unit.
Note 1: In some versions, a 120KΩ resistor is used in place of R4 and R96.
Note 2: Some versions use a 100Ω 2 watt resistor in this application.
Note 3: Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING: PRI.	RATING: SEC. 1	RATING: SEC. 2	WALSCO PART No.	Hallderson PART No.	Merit PART No.	RCA TYPE No.	Stancor PART No.	Thordarson PART No.	Triad PART No
T1	117VAC @1.76A	580VCT 5VAC @ .230ADC	5VAC @ 3A							
		SEC. 3: 6.3VAC @2.2A	SEC. 4: 6.3VAC @ 8.7A	SEC. 5						

TRANSFORMER (RELAY POWER)

ITEM No	RATING: PRI	RATING: SEC. 1	RATING: SEC. 2	WALSCO PART No	Hallderson PART No	Merit PART No	RCA TYPE No	Stancor PART No	Thordarson PART No	Triad PART No
T2	117VAC @.05A	6.3VCT @.2A			P9100 ②	P-3046 ②		PS-8415 ②	21F05 ①	F-13X

① Tape 6.3V center tap.
② Tape HV winding.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	WALSCO PART No.	Hallderson PART No.	Merit PART No.	RCA PART No.	Rem PART No.	Stancor TYPE No.	Thordarson PART No	Triad PART No
T3	Horiz. Output Trans.	CT-102 ①							
T4	Vert. Output Trans.	②	21R03 ③	A-3038 ③		V30S ③	A-8143 ③	26S53 ③	A-99X ③
T5A	Yoke(90°) Horiz. (19MM)	CT-103	DF-0071 ④				DY-18A ⑤	Y-18 ⑤	Y-41-1 ⑤
B	Vert. (40MM)								
T6	Horiz. Lin. Coil			MWC-5	209R1	20LR5A	WC-6	WC-17	WC-12
	Width Coil (3.5-21.2MH)	⑥	RF800 ⑦	MWC-11 ⑥	215R1	20LR10	WC-5 ⑧	WC-20 ⑧	WC-11 ⑧

① Trans. only. Also available as part of strip #8; horiz. output.
② Trans. only. Also available as part of strip #8B; vertical sweep.
③ Use original mounting frame.
④ Use original yoke damping network.
⑤ Connect horiz. damping network across terminals #3 and #7. Use original network, if necessary.
⑥ Not used in some versions.
⑦ Connect to terminals #1 and #2.
⑧ Connect to terminals #3 and #4.
⑨ Connect to coded red and blue terminals.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE: PRI.	IMPEDANCE: SEC.	WALSCO PART No.	Hallderson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T8	4.5KΩ	30 to 40	Z1010 ①	A-3019 ①	A-3852 ①	26S49 ①	S-52 ①	①	Fabricate new mounting.

COILS (RF-IF)

ITEM No.	USE	DC RES.: PRI.	DC RES.: SEC.	WALSCO PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No	NOTES
L1	IF Trap	0Ω						Wound on Cap.
L2	IF Trap	0Ω						Wound on Cap.
L3	Ant. Coils	0Ω						
L4	IF Trap	.9Ω						
L5	Pil. Choke	0Ω						
L6	Neut. Coil	0Ω						
L7	RF, Mixer Grid & Osc. Coil	0Ω						
L8	Pil. Choke	0Ω						
L9	Feedback Coil	1.4Ω						
L10	RF Coil	0Ω						
L11	Conv. Plate	0Ω						
L12	1st. Video IF	.1Ω		D31				Includes 41.25MC trap, 3.3KΩ resistor

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

DESCRIPTIONS

(cont)

	MALLORY PART No.	NOTES
	DC-525	
	DC-525	
	DC-521	
2	PT623	
	PT4122	
	DC-525	Note 1
	PT4122	
	PT401	
2	PT625	
2	PT6247	
	UC-5327	
	PT4147	
3	PT6247	
	DC-522	
	DC-525	
	DC-525	
12	PT624	
	PT4147	
	PT6147	
	PT601	
	PT6147	
	PT4022	
	PT6022	
	UC-521	
	UC-521	
3	PT411	
	PT6147	
	MCB463	
	MCB245	
12	PT622	
	PT4022	
	PT4022	
	PT613	
	MCL456	
		Note 1
	HV20035A	
	MCL456	
	MCL482	
'2	PT6247	
'2	PT6247	
	PT401	

unit.
)MMF.
in one unit.

LS

CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
ABT-62		Volume tapped at 50KΩ
AK-3		Attach to R1A
XB-1		Attach to R1A
		Contrast
		Brightness
		Horiz. Hold - Note
		Horiz. Drive
		Vert. Hold
		Height
		Vert. Linearity (Wire wound)

S

EM lo.	RATING OHMS	RATING WATT	REPLACEMENT DATA WALSCO PART No.	REPLACEMENT DATA IRC PART No.	NOTES
0	1.5Meg	½		BTS-1.5Meg	
1	180KΩ	½		BTS-180K	
2	270KΩ 5%	½		BTS-470K 5%	
3	5.6Meg 5%	½		BTS-5.6Meg 5%	
4	3300Ω	½		BTS-3300	
5	39KΩ	½		BTS-39K	
6	1Meg	½		BTS-1Meg	
7	100KΩ	½		BTS-100K	
8	100Ω	½		BTS-100	
9	1000Ω	½		BTS-1000	
0	5600Ω	½		BTS-5600	
1	100Ω	½		BTS-100	
2	1000Ω	½		BTS-1000	
3	82Ω	½		BTS-82	
4	22KΩ	½		BTS-22K	
5	10KΩ	½		BTS-10K	
6	10KΩ	½		BTS-10K	
7	1Meg	½		BTS-1Meg	
8	1800Ω	½		BTS-1800	
9	39Ω	½		BTS-39	
0	1Meg	½		BTS-1Meg	
1A	500KΩ	½		BTS-470K	
B	500KΩ	½	†	BTS-470K	
2	1000Ω	1		BTA-1000	
3	1000Ω	1		BTA-1000	
4	1000Ω	½		BTS-1000	
5	4.7Meg	½		BTS-4.7Meg	
6	470KΩ	½		BTS-470K	
7	27KΩ	½		BTS-27K	
8	100KΩ	½		BTS-100K	

RESISTORS (cont)

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA WALSCO PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R69	18KΩ	½		BTS-18K	
R70	5600Ω	½		BTS-5600	
R71	470KΩ	½		BTS-470K	
R72	2700Ω 5%	½		BTS-2700 5%	
R73	680Ω	½		BTS-680	
R74	3300Ω	½		BTS-3300	
R75A	27KΩ	½		BTS-27K	
B	8200Ω	½	♦	BTS-8200	
C	8200Ω	½		BTS-8200	
R76	560KΩ	½		BTS-560K	
R77	1000Ω	½		BTS-1000	
R78	180KΩ	1		BTA-180K	
R79	1.2Meg	½		BTS-1.2Meg	
R80	680KΩ	½		BTS-680K	
R81	150KΩ	½		BTS-150K	
R82	10KΩ	½		BTS-10K	
R83	1.5Meg	½		BTS-1.5Meg	
R84	680Ω	½		BTS-680	
R85	120Ω	½		BTS-120	
R86	560Ω	½		BTS-560	
R87	560Ω	½		BTS-560	
R88	27Ω	1			

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA WALSCO PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R89	220KΩ	½		BTS-220K	
R90	100KΩ 5%	½		BTS-100K 5%	
R91	100KΩ 5%	½		BTS-100K 5%	
R92	4.7Meg	½		BTS-4.7Meg	
R93	470KΩ	½		BTS-470K	
R94	1500Ω	½		BTS-1500	
R95	6800Ω	½		BTS-6800	
R96	68KΩ	½		BTS-68K	Note 1
R97	150KΩ	½		BTS-150K	
R98	5600Ω	½		BTS-5600	
R99	470KΩ	½		BTS-470K	
R100	47Ω	½		BTS-47	
R101	180Ω	2			Note 2
R102	8200Ω	2		BTB-8200	
R103	680Ω	½		BTS-680	Note 3
R104	3.3Ω	1			
R105	1000Ω	½		BTS-1000	
R106	2700Ω	5			
R107	2500Ω	20			
R108	220KΩ	½		BTS-220K	
R109	47KΩ	½		BTS-47K	Note 3

† Items R61A, R61B, C58A, C58B and C58C are combined in one unit.
♦ Items R75A, R75B, R75C, C64A, C64B and C64C are combined in one unit.
Note 1: In some versions, a 120KΩ resistor is used in place of R4 and R96.
Note 2: Some versions use a 100Ω 2 watt resistor in this application.
Note 3: Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	REPLACEMENT DATA WALSCO PART No.	Halldorson PART No.	Merit PART No.	RCA TYPE No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ 1.76A	620VCT .230ADC	5VAC @ 3A							
	SEC. 3	SEC. 4	SEC. 5							
	6.3VAC @ 1.2A	6.3VAC @ 8.7A								

TRANSFORMER (RELAY POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	REPLACEMENT DATA WALSCO PART No.	Halldorson PART No.	Merit PART No.	RCA TYPE No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T2	117VAC @ .05A	6.3VCT @ .3A			P9100 ②	P-3046②		PS-8415②	21F08 ①	F-13X

① Tape 6.3V center tap.
② Tape HV winding.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	WALSCO PART No.	Halldorson PART No.	Merit PART No.	RCA PART No.	Ram PART No.	Stancor TYPE No.	Thordarson PART No.	Triad PART No.
T3	Horiz. Output Trans.	CT-102 ①							
T4	Vert. Output Trans.	②	Z1802③	A-3038③		V305③	A-8143③	26S53③	A-99X③
							DY-16A⑤	Y-16⑤	Y-41-1⑤
T5A	Yoke(90°)Horiz. (19MH)	CT-103	DF-607④						
B	Vert. (40MH)								
T6	Horiz. Lin. Coil (1.1-4.5MH)	⑥		MWC-5	209R1	201R5A	WC-6	WC-17	WC-12
T7	Width Coil (3.9-21.2MH)	⑥	RF800⑦	MWC-1⑨	215R1	201R10	WC-5⑨	WC-20⑧	WC-11⑨

① Trans. only. Also available as part of strip #8; horiz. output.
② Trans. only. Also available as part of strip #6B; vertical sweep.
③ Use original mounting frame.
④ Use original yoke damping network.
⑤ Connect horiz. damping network across terminals #3 and #7. Use original network, if necessary.
⑥ Not used in some versions.
⑦ Connect to terminals #1 and #2.
⑧ Connect to terminals #3 and #4.
⑨ Connect to coded red and blue terminals.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	WALSCO PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T8	4.8KΩ	3Ω to 4Ω		Z1010 ①	A-3019 ①	A-3852 ①	26S49 ①	S-5Z ①	① Fabricate new mounting.

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	WALSCO PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	IF Trap	0Ω						Wound on Cap.
L2	IF Trap	0Ω						Wound on Cap.
L3	Ant. Coils	0Ω						
L4	IF Trap	.9Ω						
L5	Fil. Choke	0Ω						
L6	Neut. Coil	0Ω						
L7	RF, Mixer Grid & Osc. Coil	0Ω						
L8	Fil. Choke	0Ω						
L9	Feedback Coil	1.4Ω						
L10	RF Coil	0Ω						
L11	Conv. Plate	0Ω						
L12	1st. Video IF	.1Ω		D311				Includes 41.25MC trap, 3.3KΩ resistor

PARTS LIST AND DESCRIPTIONS (Continued)

COILS (cont)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA WALSCO PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L13	Fil. Choke	0Ω						
L14	2nd. Video IF	.1Ω	.1Ω	D312			6232 *	Includes 39.75MC trap, 8.2KΩ resistor
L15	Fil. Choke	0Ω						
L16	3rd. Video IF	.1Ω	.1Ω	D313			6233 *	Includes 47.25MC trap, 8.2KΩ resistor
L17	Fil. Choke	0Ω						
L18	4th. Video IF	.1Ω	.1Ω	D314			6232 ■	Includes 41.25MC trap, 4.7KΩ resistor
L19	Fil. Choke	0Ω						
L20	5th. Video IF	.1Ω	.1Ω	D315				Includes 39.75MC trap, 5MMF cap. & 3.3KΩ resistor
L21	Series Peaking Coil	4.2Ω			19-3093	TV-181	6177	93 Microhenries
L22	Shunt Peaking Coil	17Ω			19-3500	TV-188	6174	500 Microhenries
L23	4.5MC Trap	.1Ω			20-1004			
L24	Series Peaking Coil	8Ω			19-3125		6153	120 Microhenries, wound on 39KΩ resistor
L25	Series Peaking Coil	8Ω			19-3125		6153	120 Microhenries, wound on 39KΩ resistor
L26	Shunt Peaking Coil	17Ω			19-3500	TV-188	6174	500 Microhenries
L27	Sound IF	2.9Ω	2.9Ω				6203	
L28	Ratio Det.	4.6Ω	1.2ΩCT				1498	Tertiary winding -.2Ω
L29	Horiz. Osc.	110Ω						

* Add 8.2KΩ resistor externally.
■ Add 4.7KΩ resistor externally.

FILTER CHOKE

ITEM No.	RATINGS TOTAL DIRECT CURRENT	RATINGS D. C. RESISTANCE	RATINGS INDUCTANCE (0 CURRENT 1000 ∿)	REPLACEMENT DATA WALSCO PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
L30	.230ADC	37.7Ω	1.1HY			C-2974		26C44 ①	C-23X

① File out mounting hole.

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA WALSCO PART No.	SYLVANIA PART No.		NOTES
M1	1N64*		1N60 or 1N132		Video Det.

* Some versions may use 1N60 crystal diode in this application.

MISCELLANEOUS

ITEM No.	PART NAME	WALSCO PART No.	NOTES
M2	Tuner		VHF
M3	Relay		Power (On-off)
M4	Relay		On-off (Motor tuning)
M5	Switch		Channel Selector (Tuner)
M6	Switch		Channel Selector (Remote lead)
M7	Motor		Channel tuning
M8	Focus Magnet		Includes centering device
M9	Printed Circuit Strip	#1	Video IF
M10	Printed Circuit Strip	#2	Video Amp.
M11	Printed Circuit Strip	#3	Sound IF
M12	Printed Circuit Strip	#10A	Audio Amp.
M13	Printed Circuit Strip	#7	Vert. & horiz. sync.
M14	Printed Circuit Strip	#6B	Vert. Sweep
M15	Printed Circuit Strip	#5	Horiz. Sweep
M16	Printed Circuit Strip	#8	Horiz. Output
M17	Power Supply Unit	#4	
M18	Printed Circuit Strip	#9	Video Control

TROUBLE SHOOTING AIDS (cont)

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V21, V22, V23 and V24. Check waveform W17.

If Satisfactory	If Unsatisfactory
Check T3, T5A, C82, C83, C84, C80, R102, R103 and other associated components.	Check L29, C76, C77, C78, R95, R97, R94 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V22, V23 and V25. Check R5, R103, R102, C78 and other associated components.

BLOOMING

Check by substitution V22, V23, V24 and V25. Check C78, R102 and other associated components.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video".

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or no Sound".

RASTER, NO SOUND, NO PICTURE

Check by substitution V1, V2, V3, V4, V5, V6, V7 and V8. Check video IF components for failure or change of value. Check remote control relay.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set".

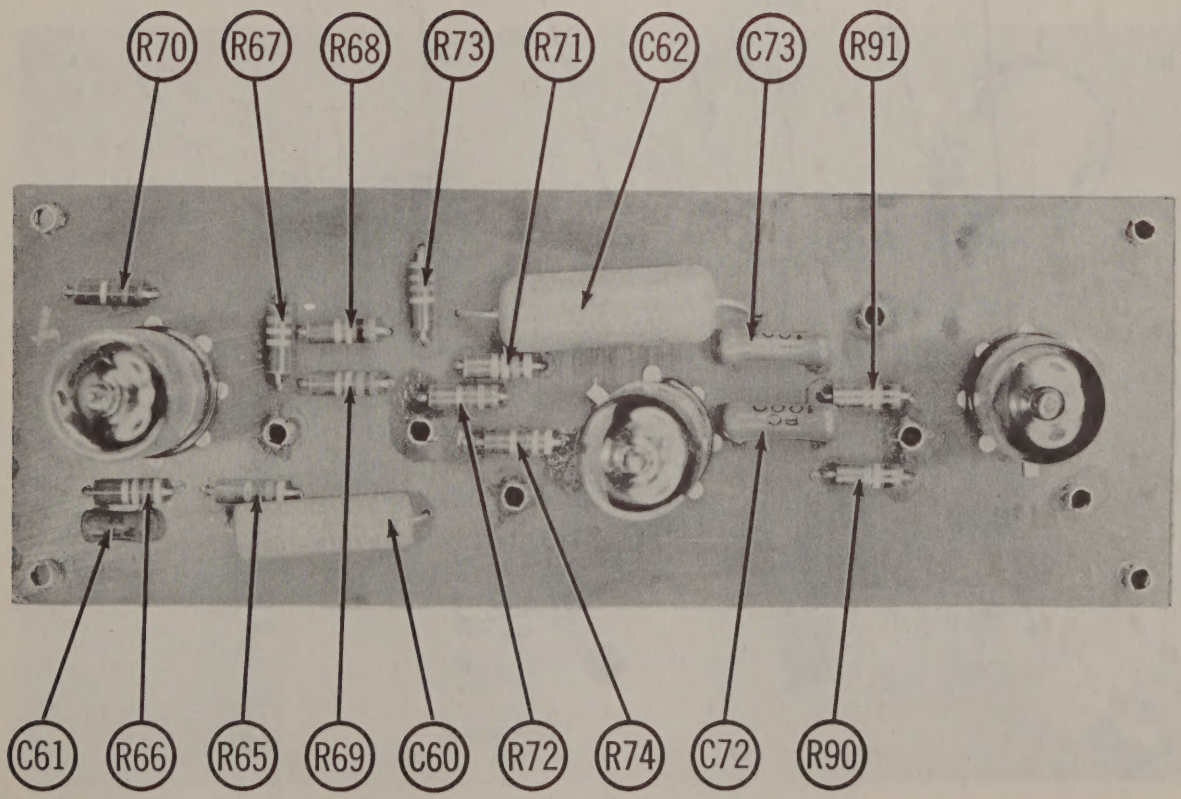
KEYSTONE EFFECT

Check T5 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



SUB-CHASSIS #7 SYNC UNIT

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENT

Touch-up adjustments of the VHF tuner oscillator circuit may be made thru the small hole in tuner case to the right of the channel selector shaft from the rear of the chassis.

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

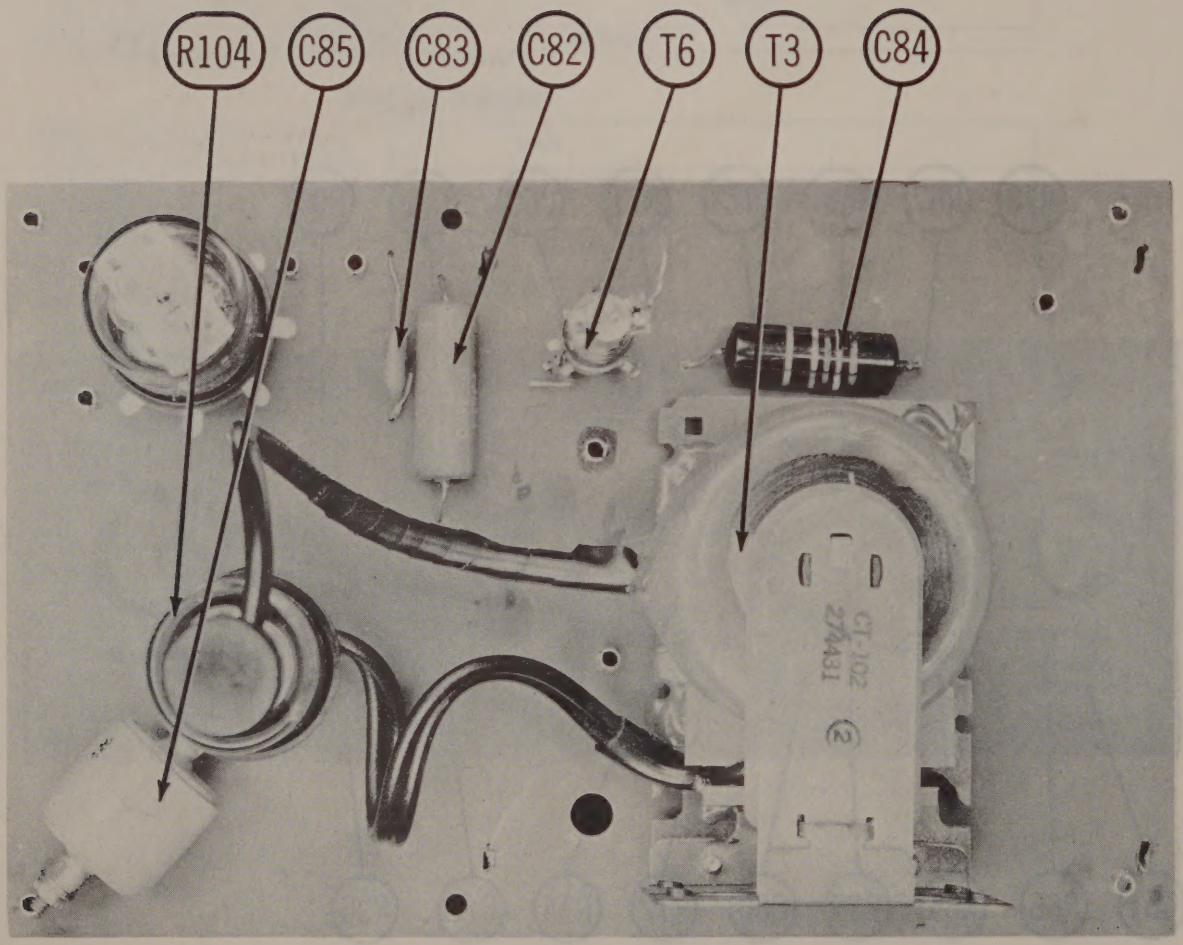
Adjustment of the horizontal oscillator is located on top of chassis. Set the horizontal hold control at the center of its range and adjust the horizontal oscillator slug (L29) until picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the ratio detector secondary (L28) located on top of the chassis.

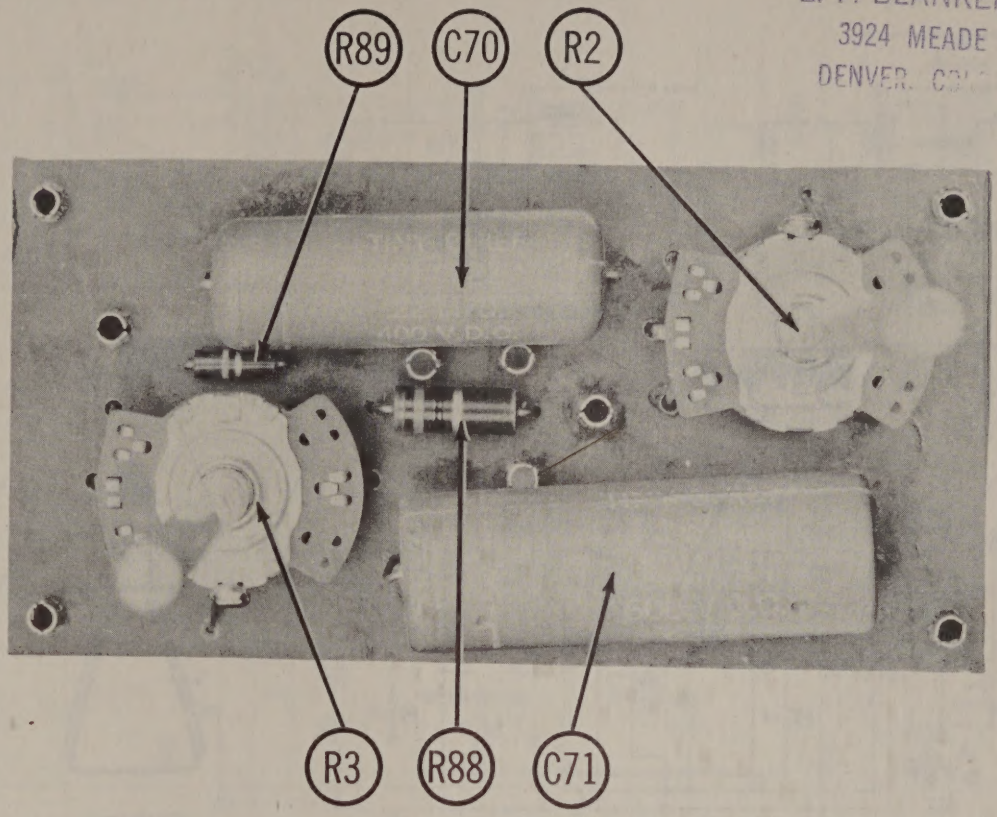
CENTERING

Centering is accomplished mechanically by means of a centering lever on the PM focusing assembly. Adjust the centering lever from side to side, and up and down until the picture is properly centered.

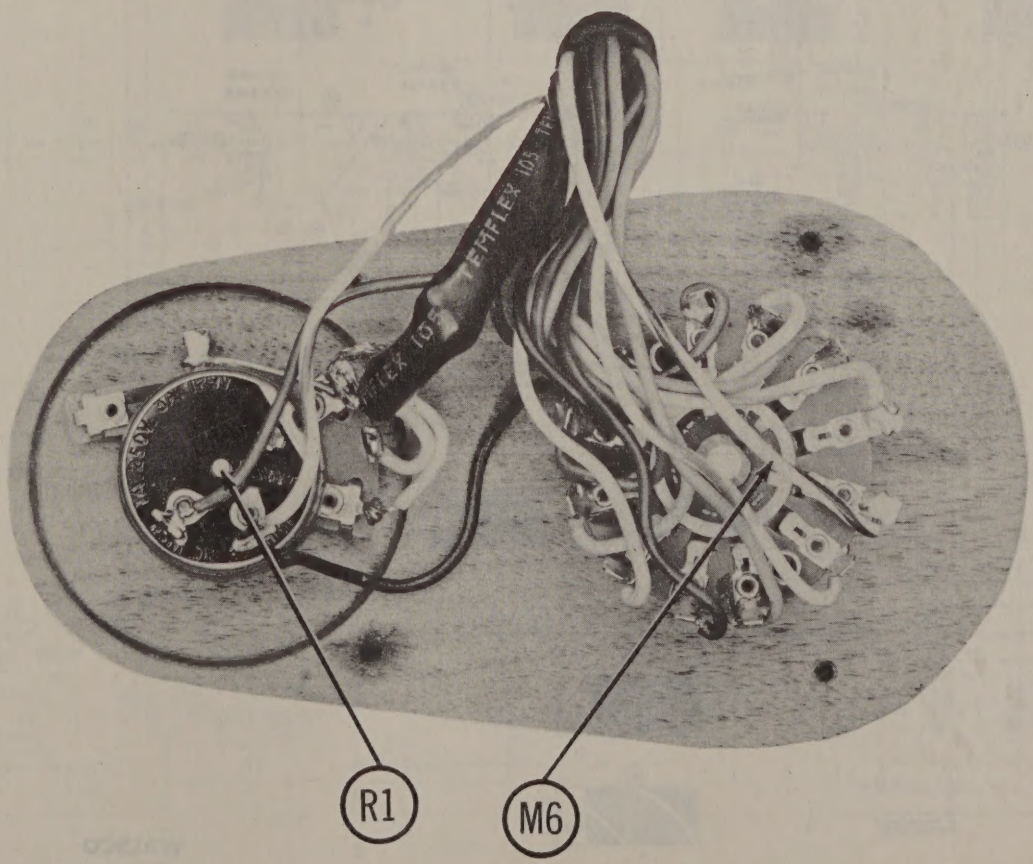


SUB-CHASSIS #8 H.V. UNIT

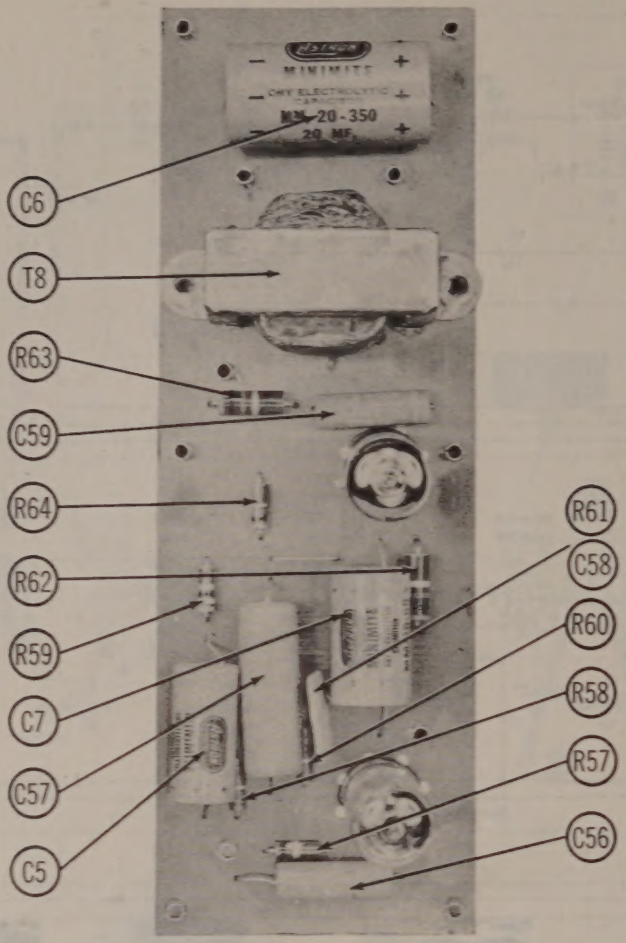
PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLO.



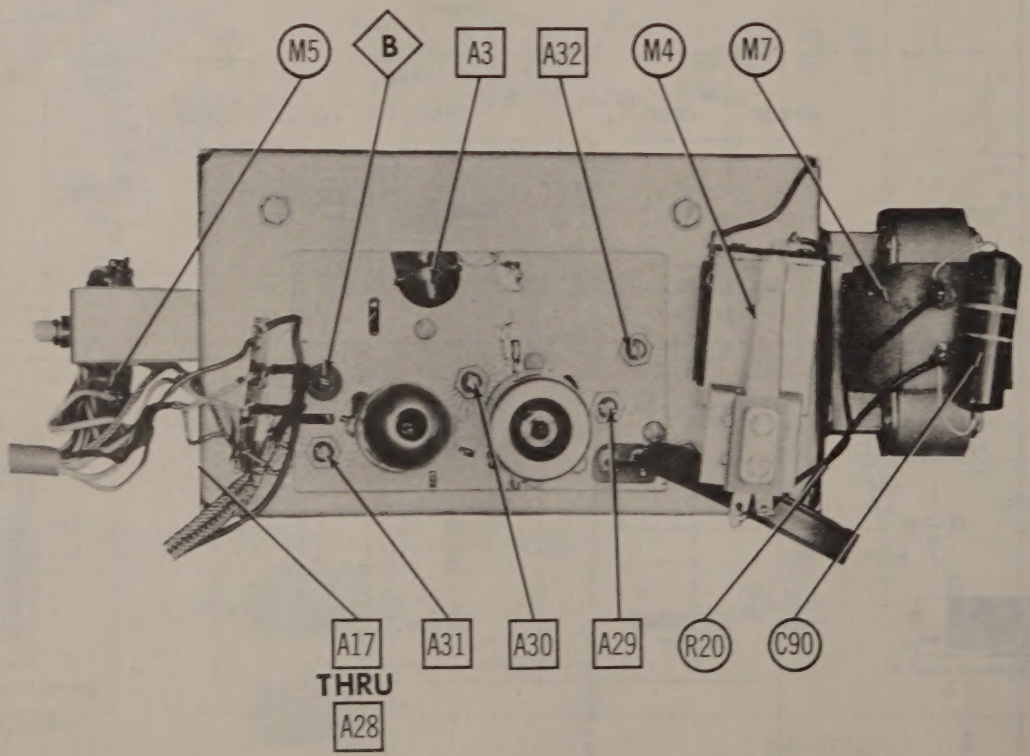
SUB-CHASSIS #9 VIDEO CONTROL UNIT



REMOTE HEAD



SUB-CHASSIS #10A AUDIO OUTPUT UNIT



SUB-CHASSIS #11 RF TUNER (TOP VIEW)